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ABSTRACT

Resources for the Future, Inc. (RFF) is a nonprofit, tax exempt corporation headquartered in Washington, D.C. RFF's purpose is to advance research and education in the development, conservation, and use of natural resources, including improvement of the quality of the environment. Most of its programs are carried out by resident staff, but a few are supported through grants to universities and other nonprofit organizations. Most studies are in the social sciences and are broadly concerned with relationships of people to the natural environment. Provided in this report is a selected representation of RFF's research programs and activities, concentrating on new projects and completed work. Programs and activities are described under the following headings: Energy and Materials (international oil markets and energy security, petroleum exploration in developing countries, transport fuels in developing countries, natural gas research program, effects of coal policy, mineral economics and policy, atmospheric impacts of global development, economics of space); Symposium (the International Atomic Energy Agency and nonproliferation); Quality of the Environment (data lack stymies benefits work, questioning methodology, contingent valuation, benefits of avoiding giardiasis, fish and hydropower, microeconometric analysis of producer behavior, current issues in U.S. Environmental Policy, reducing hazardous wastes); Workshop (discounting future lives); Renewable Resources (solving long-term water problems, agricultural sources of water pollution, barriers to forest products trade, forests and biological diversity); and National Center for Food and Agricultural Policy. Also included is a presidential essay ("The Forgotten Hinterlands: Rural America" by Emery N. Castle, RFF president), conferences and workshops, publications (six books and one study), fellowship and grant programs, and information on policy education, outside staff activities and publications, staff changes, independent accountants, and support sources. (TRS)

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ANNUAL REPORT 1985

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Resources for the Future, Inc. (RFF) is a nonprofit tax-exempt corporation chartered under the laws of the state of New York, with headquarters in Washington, D.C. It was established in October 1952 with the cooperation of the Ford Foundation.

The organization's purpose is to advance research and education in the development, conservation, and use of natural resources, including the quality of the environment. Most of its programs are carried out by resident staff, but a few are supported through grants to universities and other nonprofit organizations. Its studies are primarily in the social sciences and are broadly concerned with the relationships of people to the natural environment.

This report does not cover the whole of RFF's research programs and activities. Rather, it is a selective presentation, concentrating on new projects and on completed work, including the seven books and studies published during the year. Inquiries are welcome concerning work in progress or additional details of programs reported here.

RFF's research and other work are supported by grants and contracts from foundations, government, and private industry. Details are available in the Financial Statements section beginning on page 89.

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RESOURCES FOR THE FUTURE

ANNUAL REPORT

FOR THE YEAR ENDING SEPTEMBER 30, 1985

1616 P Street, N.W., Washington, D.C. 20036

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The policy of Resources for the Future is to promote the realization of equal opportunity through affirmative action. In the belief that it can improve their representation on its staff, the organization seeks actively to recruit, hire, train, and promote minority and female persons in all job classifications. For all research positions, in particular, careful consideration is given to minority and female candidates who may lack formal qualifications but whose experience and talent suggest special promise.

At Resources for the Future it is unacceptable that certain groups of people arbitrarily be denied opportunity open to others. Accordingly, no one will suffer discrimination in any personnel action based on his or her race, color, religion, sex, national origin, age, handicap, or veteran status, including disabled veterans and veterans of the Vietnam era. Management is responsible for establishing and accomplishing goals, evaluating progress, and correcting deficiencies.

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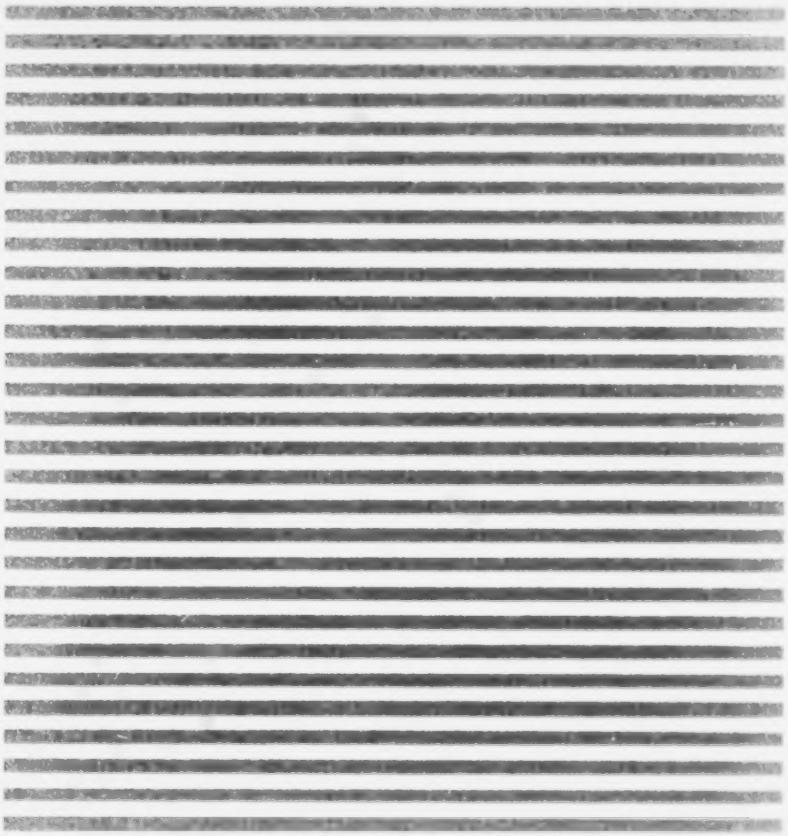

THE FORGOTTEN HINTERLANDS: RURAL AMERICA

by EMERY N. CASTLE

We know more about stimulating economic activity in an underdeveloped society than we do about improving the performance of bypassed people and areas within an affluent society.

Former foundation program officer

There is great change in rural America. The picture many carry of a serene and untroubled countryside is not accurate today and probably never was. The signs of change are many. Some indicate fundamental malfunctioning of our economic and social systems; others are the inevitable consequence of social and economic growth.

The economic distress of our farmers fills the news media and congressional hearings, and with good reason. Farmers' debt problems and low incomes affect not only rural communities and businesses but urban financial institutions as well. People are worried about the loss of agricultural land to urban areas, so much so that land preservation is one of the most popular and rapidly growing philanthropic activities in the United States.

Other issues are not nearly so well known. Rural poverty rates outstrip those in urban areas, and unemployment in the countryside, especially seasonal unemployment, runs very high in some areas. Alcoholism and other indications of social maladjustment are (or should be) matters of concern, and social investment in many community facilities is declining. Much rural land use contributes to national environmental deterioration through soil erosion and the use of pesticides.

We are a far cry from a purposeful set of policies to help rural areas cope with change. In part this is because many of those in positions of power and influence have an outmoded concept of rural life and society, and few agree about the nature and cause of the problems. The ills of the inner cities are severe, but we probably are closer to consensus about their nature and what might be done about them than we are for many rural problems.

Another reason for neglect is political: no interest group or political unit can speak for rural America. Because rural areas are so diverse, no single issue or set of issues can bring rural people together. Because the

United States is very large, it is difficult for rural residents to communicate and organize politically.

Myths and misconceptions

Some believe that if only we could solve the farm problem, rural difficulties would disappear. But in 1980 less than 5 percent of the personal income of nonmetropolitan residents came from agriculture, forestry, and fisheries, and only 16 percent of the employment in nonmetropolitan areas was provided by these industries. Land in farms accounts for about one-half of rural land use, but only 10 percent of the rural population lives on farms. As important as the farm problem is, a solution would leave much of rural America essentially unchanged. "Rural" has not meant "agrarian" in the United States for a long time.

Conventional wisdom notwithstanding, U.S. agriculture is not threatened by urban growth. Social problems may plague the rural-urban fringe, but typically they are local in nature and do not jeopardize the national food supply. Urban competition for land, water, labor, and capital often improves the markets for these resources; rural-urban fringe *problems* and *opportunities* often go together.

Nor is it true, as many seem to believe, that rural areas are mostly alike with nearly identical problems. Much rural land is publicly owned, but most is held privately. Some rural residents have considerable assets and income, others are poor, and some are very poor. Some rural areas are beautiful, with desirable climates and well-functioning social institutions; others are uninteresting to many people either because of climate or scenery or poorly developed social institutions. Thus, any single program or activity is unlikely to go very far in addressing the myriad adjustments facing rural citizens.

Rural resource problems: Human and natural

Despite their reputation for self-reliance, rural people long have known that the solution to many social problems can be found only in cooperation and group action. The early provision of education, frequently in one-room schools, provides an example. The establishment of Land Grant Colleges during the Civil War expressed this commitment at the national level. In the beginning, of course, these institutions were based on a much simpler economy than now exists. When most people in the countryside were closely associated with agriculture, forestry, mining, or fishing, their

needs and their values were much more likely to be similar and it was easier for educational and other institutions to serve their needs. But, as noted earlier, these industries no longer dominate the rural areas. Manufacturing, government employment, and trade each provide twice as much employment in nonmetropolitan areas as do agriculture, forestry, and fishing combined.

Two types of human resource needs are readily apparent. Because of assorted personal preferences and lower living costs, the countryside may well attract a higher percentage of people who, for whatever reason, are less able to function well in the mainstream. The rural population is older than is true for the nation as a whole. Rural areas have more than their proportionate share of retired poor, and more of the rural poor are ill or disabled.

A different set of institutions is needed to serve those who are young and able and who wish to improve their lot. Historically, education—generally, public education—was the gateway for rural young people to enter the urban-oriented society. Is education the powerful link to meaningful participation in the larger society it once was? Certainly the opportunities for educational experiences, both for youths and adults, have expanded greatly over time.

But we know much less about whether and how these experiences help bring about meaningful participation than we should, and because of this it is far from clear that educational institutions are serving rural residents as effectively as they once did.

During the past three decades some rural communities have been emptied of most of their people and now confront a crumbling social infrastructure. Others have had to cope with enormous growth when a manufacturing plant has located nearby, or when they come within commuting distance of an urban center. This rapid change in the numbers and composition of the rural population makes it difficult to plan for the needed investment in social services and may destroy, at least temporarily, the sense of community that is critical both to group decision making and the quality of life.

The problems of natural resource management in rural areas also are distinctive.

When farming in marginal areas becomes unprofitable, is the disinvestment or adjustment cost in part a social responsibility . . . ?

Environmental quality. Widely dispersed polluting sources create different problems than do those that are highly concentrated. Sedimentation of streams from soil erosion and extensive use of toxic pesticides are challenging examples. Will an urban-dominated society that places high value on environmental quality long tolerate threats to that quality from an agricultural industry that suffers from chronic overproduction?

Marginal fragile lands. U.S. land-use controls are unique in the world. Authority to define and control private property rights is vested in the states and is guarded zealously by them. Even so, the federal government often develops programs and policies that influence greatly the value of specific property rights.

The amount of land in cultivation at a given moment is a matter of constant adjustment: when prices are high and conditions favorable, farmers expand into marginal lands; when conditions become less favorable, human and capital resources are trapped in these areas. Sometimes disinvestment occurs at the expense of those who decided to farm such land, but public support often is extended through generous credit programs and expensive land retirement plans. Some areas have been in and out of crop production several times in this century.

This continuous adjustment at the margin raises several questions. Is expansion solely the result of market signals, or is it encouraged by income tax laws and government programs like price supports? When farming in marginal areas becomes unprofitable, is the disinvestment or adjustment cost in part a social responsibility or should it be borne entirely by the settler? What effect does this pattern of use have on the land resource itself? Is it reducing the land's long-run value in some other use, such as grazing or outdoor recreation? Clearly, we are a long way from adopting policies for these lands that are realistic with respect to property rights, individual incentives, and social objectives.

Public values and rural land use. Travel in the rural areas of Europe impresses one with the intensive multiple use there; the public interest in these lands long has been recognized and protected. While the same institutional arrangements usually cannot be adopted in this country, we

clearly need to give more thought to harmonizing public and private rights in rural land use. Some lands are capable of producing substantial public values. Certain wetlands, for example, may provide for wildlife preservation and outdoor recreation, while other areas offer scenic delights.

We are well aware of the conflicts that arise on the public lands when public and private land uses coexist. Much less attention has been given to capturing significant public values on privately held lands even though it is clear that in many instances private use and public values are compatible.

But in other cases it is not clear that public or private values are being accommodated well. A case in point is the conversion of certain wetlands to agricultural production, encouraged by government programs, in the face of chronic agricultural overproduction. But even without government encouragement, private landowners may have little incentive to take public values into account. We need to know more about the potential public values of such land as well as its contribution to the competitiveness of U.S. agriculture.

Rural area policies

Better rural area conditions depend on the kind of economic activity that can be sustained there and on a set of reasonably consistent policies. To concentrate either on the public or the private sector to the exclusion of the other will not do much to improve matters.

Goodness knows the rural areas have not been neglected by government. After manufacturing and property income, government is the third-largest provider of income in both metropolitan and nonmetropolitan areas. Given budget pressures at all levels of government, however, future outlays are likely to be closely scrutinized, and, because most people live in urban areas, public funding for rural areas may be difficult to obtain. This is even more likely to be true when program effectiveness is questionable.

More effective rural area programs and policies depend on an understanding of rural people, social organizations, and economies, but there is no sustained intellectual effort that can provide this understanding. A few years ago a National Rural Center was established, but it failed to attract continuing support and no longer exists. Rural sociology is a respected area of study, but the people working in this field are few and

Rural area policies must recognize the extent to which our society is dominated by urban values and processes.

scattered. Some scholars in various other disciplines are working on facets of rural problems, but they are out of touch with one another and their work is not cumulative. Agricultural economics has focused mainly on commercial agriculture and natural resources with a consequent neglect of rural people and communities. In contrast, urban studies programs are approaching middle age and impressive textbooks catalog and analyze urban problems and suggest policies.

It would be most useful to draw upon a comprehensive body of literature of rural studies when proposing a base for public policy. In lieu of that, I offer here three broad truths that I believe will need to be accommodated by any set of effective policies.

Working with the urban society. Rural area policies must recognize the extent to which our society is dominated by urban values and processes. This is not to deny the value or the charm of rural customs, people, and areas; but these values must be harmonized with the urban culture and the urban economy, or failure is certain.

The rural areas best able to cope with economic changes have been those that are closely integrated with urban society. Farmers located near urban areas have a better market for their land and excess labor than do those who live farther away. Areas that are heavily oriented to outdoor recreation have higher incomes and less poverty than rural areas in general. During the last few difficult years in farming, off-farm employment for farmers and their families stabilized farm income in many areas.

Many rural areas have invested a great deal to attract industry to their communities. The payoff is sometimes enormous, as in the General Motors decision to locate its Saturn project in the Tennessee countryside. But every spectacular success means dozens of disappointed suitors. And some of these industries are themselves sources of instability. Kenneth Deavers of the United States Department of Agriculture fears that many rural area industries may decline in coming years. He cites textiles as an example of an industry that provides substantial rural employment but that faces stiff competition from abroad.

The productivity of natural resources. Some in rural areas have concluded that a good way to better their lot is to increase the productivity

of natural resources. Certain fundamentals need to be kept in mind as such policies are considered.

Economic growth typically involves developing processes and institutions that permit fewer natural resources to be used in the production of food, fuel, and shelter. As incomes rise, the relative increase in demand for these primary needs is less than it is for those that expand the range of items that are consumed and enjoyed. When the productivity of natural resources in agriculture, forestry, fishing, and mining is improved, the result often is that fewer human as well as natural resources are needed per unit of output. Improving productivity may be desirable nationally, but fewer jobs may not improve the health of rural communities.

Of course, the demand for some activities that use lots of land increases as the income of a nation improves. Take much of outdoor recreation, for example, which historically has been provided at little or no cost by the government. As outdoor recreation policies are revised and changed, the recreation potential of some rural communities may open opportunities they have not had in the past. European countries have been far more successful than has the United States in mixing and integrating outdoor recreation experiences with other natural resource uses.

Higher personal incomes and especially the creation of retirement programs have spurred growth in many rural areas. Many persons choose retirement homes away from urban areas because living costs often are less and they find rural living to be more attractive. But as people work longer it is not certain that this trend will continue. Retirement in the future may not be as distinct from working employment as it has been in the past.

Rural property and property rights. Rural land-use policies too often have poorly understood objectives and inconsistent means. No other area of social policy suffers more from a lack of rigorous analysis and careful scholarship.

An unstated assumption of many policies is that land is scarce and that it must be preserved for some future use, usually farming. Accordingly, minimum acreages often are mandated. But when minimum acreages are combined with subsidized mail service and roads, rural residences and

. . . we cannot know where to go until we know where we are, and the gaps in basic information about both physical and human resources are wide and deep.

rural sprawl are encouraged. The commercial farmer who tries to assemble substantial acreage for a viable economic unit may be placed at a competitive disadvantage. While the resulting residential land parcels may produce some farm products or timber, they often provide only a fraction of family income.

On the other hand, some communities may wish to encourage population growth and rural residences. If so, they must decide whether to disperse or concentrate new settlement. It is true that the restrictive policies of cities often drive people to the countryside where policies encourage rural sprawl, but this need not be the case. Many European countries have encouraged concentrated settlement even as incomes have risen and automobiles proliferate.

In conclusion

Too much of rural America has become a residual claimant on the resources of a society that is dominantly industrial and urban. Some rural communities and many individuals clearly are better off than they were two or three decades ago, but rural poverty is growing and the economic base of many rural areas is under increasing pressure.

What is needed—badly needed, in my opinion—is a program of intellectual endeavor for the rural areas comparable to the urban economics and regional studies that Resources for the Future launched almost three decades ago. The agenda for such a program potentially is enormous, but it should begin with assessing existing conditions: we cannot know where to go until we know where we are, and the gaps in basic information about both physical and human resources are wide and deep. Concurrently, we should ask if our policies and programs are taking us in the direction we would like to go; in too many instances they are counterproductive or inconsistent.

This is neither a call for RFF to undertake such an effort nor a prediction that it will. A rural studies program would take RFF too far afield from its central focus—resources and the environment. But to make this point is to restate a major reason why we need to be reminded of these issues. Rural problems do not fit neatly into the mission of any of the major public or private institutions. The government institutions that might be expected to work on such problems are struggling to survive. Public and

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private funders favor more popular and tractable issues over the tough and relatively out-of-sight afflictions of rural America.

The problems are so difficult that there is a great temptation to say they are hopeless and to ignore them, especially at a time of tight budgets and scarce resources. Even so, important and practical steps can be taken that would cost very little.

Individuals and organizations concerned with natural resources, human resources, economic activity, and institutional performance could give special attention to rural issues, often without stretching their agendas too far. Statistics will reveal many of the differences between urban and rural areas, but firsthand observation of some rural communities would provide the "flesh and blood" behind the cold statistics. This can be a sobering experience, and I highly recommend it.

Activities that inform us about rural conditions, like those in the departments of Commerce and Agriculture, need to be maintained. They do not cost much, but discontinuing them would deprive us of a wealth of information such as the facts cited in this essay.

Scholars and others concerned with rural issues need to be identified and encouraged. No doubt they would be more productive if they were to get together from time to time to exchange information.

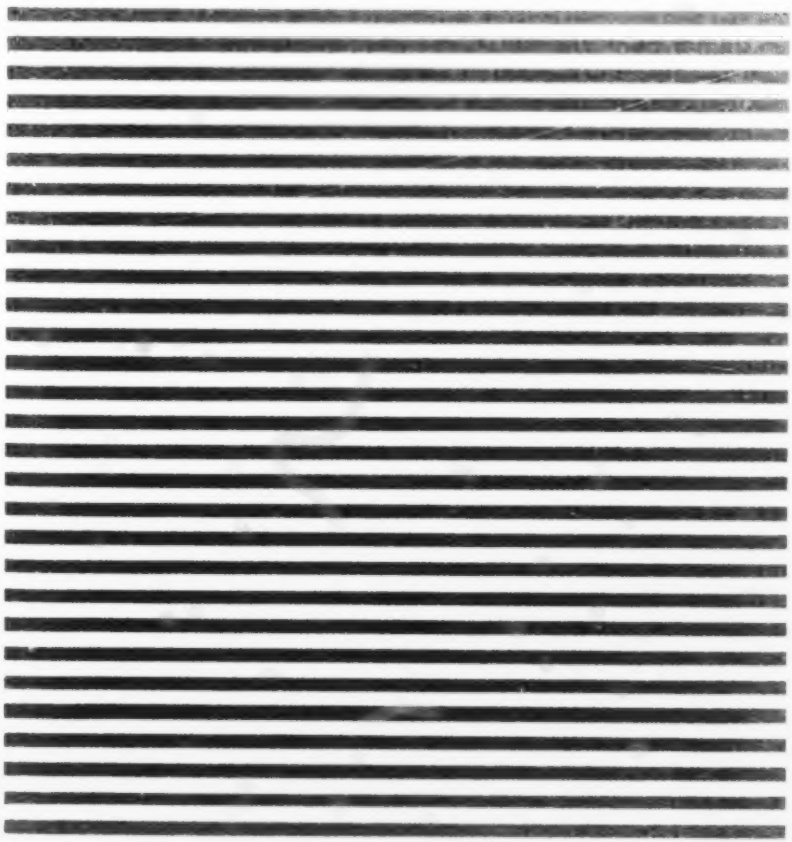
Our pattern of settlement will continue to evolve and change, yet the problems of rural America will not go away. A healthy society cannot afford to ignore serious social distress, be it in the inner cities or in the forgotten hinterlands.

Emery N. Castle, president of Resources for the Future since 1979, has announced his resignation and his intention to leave the organization in early 1986.

Castle joined RFF as vice president in December 1975 after distinguished service at Oregon State University. While there he held a number of top positions, including dean of the graduate school, director of the Water Resources Institute, and head of the department of agricultural and resource economics. His tenure at RFF was marked by the financial strengthening of the institution, thus ensuring its continuing independence and objectivity, and by program innovations, including the establishment of the National Center for Food and Agricultural Policy and small grant and fellowship programs.

Castle will return to the Pacific Northwest, where he has strong family and other ties. He plans to do research and write on the problems of rural America.

Year's work in review



ENERGY AND MATERIALS

In addition to describing research on "conventional" resources, such as energy and minerals, the following pages demonstrate the changing concept of what comprises natural resources. Thus, valuable assets like the biosphere, once excluded from the domain of economic natural resources, now have moved into the province of scarcity. Indeed, the limited capacity of air, land, and water to absorb the by-products of combustion, industrial activity, and farming have by now made these environmental "sinks" central constituents of the economic endowment of natural resources. Other entries into the economic natural resource fold are the electromagnetic spectrum and geostationary orbital arc, each with properties of great value to those with access to them. This raises the need for allocation rules that reward efficiency and spur technological advance. We begin with energy and minerals and conclude with examples of these newer types of resource issues.

International oil markets and energy security

Two studies by Douglas R. Bohi and Michael A. Toman represent elements of a broader program of research on international energy markets and institutions, including how economic and political systems adjust to abrupt changes in economic conditions. Both have been issued as RFF discussion papers.

One element of recent change in oil markets is the emergence of active spot and futures markets for crude oil and petroleum products, with broad implications for market stability and for the prospective role of governments in responding to short-term crises. Bohi and Toman analyze the behavior of trading in futures contracts for petroleum products to determine how information about futures prices and trading volumes can be used to draw inferences about oil market conditions and the behavior of participants in the market. In addition to better understanding the dynamics of the market, this study is motivated by the need for timely information about underlying conditions in the market as a crisis is unfolding. Using a combination of theoretical and empirical analysis, the authors examine four recent shocks to the oil market to demonstrate that futures market activity provides valuable information that can be used to assess conditions during a crisis.

Although energy security is not now a pressing political issue, advance planning is crucial, especially if the response to a crisis is to involve

The Energy and Materials Division conducts policy-related research on energy demand and supply, nonfuel minerals, and a number of specialized natural resource issues.

coordinated policies among several oil-importing countries. Present plans for international cooperation, as reflected in International Energy Agency (IEA) agreements, are widely regarded as inadequate, and no consensus exists among IEA members on how to strengthen them. In particular, the United States strongly favors an agreement that emphasizes coordinated use of strategic oil stocks and opposes restraints on oil demand during a crisis, while other key IEA members hold precisely the opposite view.

While agreeing in principle that expanding stockpile coordination confers substantial mutual benefits, Bohi and Toman argue that such a goal is not now feasible because of diverging interests and positions of IEA members. At the same time, however, strengthened international agreement is urgently needed to avoid the risk of inadequate or nonexistent responses by individual oil-consuming countries. Therefore, the authors conclude that an agreement on mixed responses, with the United States favoring use of its Strategic Petroleum Reserve while other IEA members emphasize effective demand restraints, not only offers the best chance for acceptance but also could yield significant mutual benefits to participating nations.

Petroleum exploration in developing countries

It is widely believed that a number of non-OPEC developing countries (NODCs) contain, relative to their consumption needs, sizable amounts of economically exploitable petroleum resources. But despite the tremendous increase in the real price of oil in the last decade, exploration activity in many of these areas has not increased appreciably. In fact, some NODCs have seen a decline in petroleum investment while the lion's share of exploration activity has continued to take place in established areas such as North America and the Middle East.

The benefits of exploiting NODC petroleum resources could be consequential. For the countries themselves, it would mean lower import bills; for oil-consuming countries in general, it would produce a more diversified world oil market and downward pressure on prices. So it is something of a puzzle why the pattern of oil-exploration in NODCs is so uneven and why such activity, in general, is languishing.

Harry G. Broadman has identified some of the pieces of this puzzle and explains how they fit together. His approach was to develop a set of testable hypotheses that could reveal the extent to which constraints on

exploration arise from poor geologic prospects on the one hand, and economic, institutional, and political elements on the other. For if it is not a question of resources, policy may have a role; but, if the constraints relate to resource potential alone, policy is useless. In addition to this *cross-country* dimension, Broadman also developed a set of hypotheses about *cross-company* patterns of oil exploration. International petroleum companies differ considerably in their foreign investment strategies, and understanding why some firms are attracted to particular areas and others elsewhere is important in designing policies to bring about more exploration.

To test these two sets of hypotheses statistically, Broadman assembled data for 1970–1982 on an extensive variety of factors, including wildcat drilling, seismic testing, acreage acquisition, contractual terms, tax rates, political risk, and infrastructure development, covering more than sixty countries and forty (U.S. as well as non-U.S.) petroleum companies.

Empirical analysis of the cross-country determinants suggests that the market for exploration is segmented between, in relative terms, geologically promising, oil-producing countries and less-promising nonproducing countries. Geological elements have a pronounced impact in both sets of countries. Factors unrelated to resource potential tend to exert a strong influence on the scope of exploration in producing areas, but appear to be considerably less important in unpromising, nonproducing areas where geology is essentially the determinant. Among the nonresource factors unrelated to resource potential that were analyzed (apart from pure economic elements like price and well depth, a proxy for drilling costs), contractual arrangements and, to a lesser extent, taxes seem to have the most powerful effects. Infrastructure development appears to play a more modest role. Somewhat surprisingly, there is little hint that—to the extent it was statistically measurable—political risk has much influence; but this deserves further attention. Taken together, these results are consistent with a systematic process of oil exploration in which geologic promise is a necessary, though not sufficient, condition for investment.

The empirical evidence emerging from this research suggests several areas where policy actions may be productive. Some host governments probably are offering contractual arrangements that, given the discovery prospects, provide for an insufficient amount of risk-sharing with foreign

investors, thus deterring investment. Moreover, the level of taxation in some countries is likely to be too high (given the amount of risk-sharing). In the case of both onerous contractual and taxation arrangements, host governments clearly have the power to enhance incentives for exploration. In contrast, there is some evidence that inadequate physical infrastructure—ports and transport facilities, for example—may deter exploration, all other things being equal. In cases where this is true and the capital investment required to develop the necessary infrastructure is large, some countries may find it difficult to raise the money from local sources and need to obtain support from multilateral lending organizations like the World Bank.

Finally, the project uncovered evidence that large, vertically integrated firms may not be eager to explore in areas with little likelihood of producing large finds. Governments of countries with relatively small fields that want to attract foreign investment in exploration would do well to design their contractual and fiscal systems to make the investment costs less imposing to smaller, less-integrated firms than they otherwise might be.

Broadman's two-and-one-half-year project was supported by the U.S. departments of Energy and State.

Transport fuels in developing countries

Transportation, which already accounts for about half of all oil used in developing countries, is expected to rise rapidly with economic growth, both as cause and effect. Industrialization and agricultural development imply increased freight and passenger transport, and higher real incomes stimulate demand for leisure-related transportation. Furthermore, possibilities of fuel switching are limited.

Continued rapid expansion in consumption of petroleum products will exacerbate problems of economic management in oil-importing developing countries; for many, the importation of transport fuels alone is equivalent to 20 percent of total export earnings. Rising consumption of transport fuels, by cutting into exportable surpluses, also poses problems for some oil-exporting countries.

In these circumstances, gaining a clearer idea of the factors determining transport activity and the likely growth in consumption of transport fuels, and evaluating policies that could modify this trend while still providing

the transport service necessary for economic development, are of interest not only for energy management but also for wider macroeconomic policy aims.

With support from the U.S. Agency for International Development, Joy Dunkerley and Irving Hoch, assisted by Caroline Boudhili, examined these relationships. Using an energy/transport data base developed for this study, Dunkerley and Hoch found that consumption of transport fuels and the stock of road vehicles tend to rise substantially faster than income. At the same time, per capita consumption of transport fuels and vehicle ownership falls less than proportionately as price increases (see accompanying table).

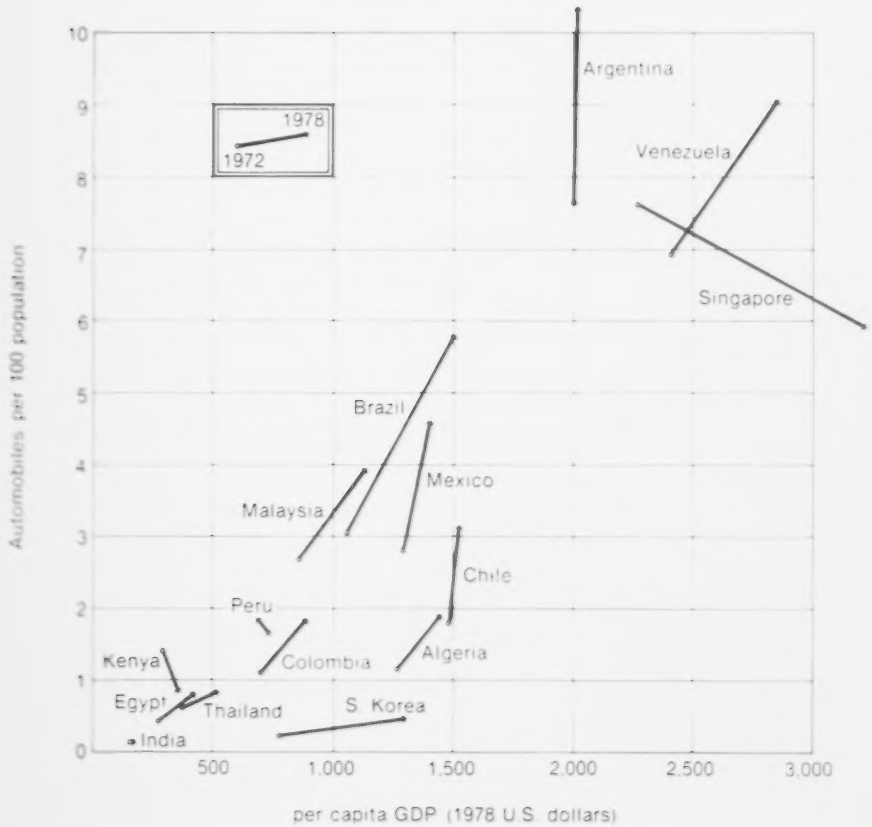
The relationship between rates of passenger car ownership and income are shown in the graph. For almost all countries shown, a sharp increase in car ownership took place between 1972 and 1978 (despite a 60 percent increase in the real price of gasoline). A notable exception is Singapore, where car ownership declined despite a strong rise in per capita income. This unexpected result is attributed to the introduction of Singapore's Area Licensing Scheme, which sharply increased the costs of private passenger car entry into the central business district.

Assumptions about future trends in prices and incomes combined with the indicated high income and low price elasticities suggest that con-

Prices and Income Elasticities for Transport Fuels and Vehicles in Developing Countries

	Income elasticity	Price elasticity
Total energy transport	1.2	−.15
Road transport fuels	1.3	−.2
Motor gasoline	1.4	−.4
Automobiles	1.65	−0.65
Trucks	1.1	−0.5

Note: Elasticities measure the sensitivity of consumption to changes in prices and income. For example, the results given above suggest that for transport energy as a whole, a 10 percent increase in per capita income brings about approximately a 12 percent increase in per capita consumption, while a 10 percent increase in prices implies a drop of only 1.5 percent in consumption. Automobile and truck figures refer to per capita stocks of registered vehicles.



Automobiles per 100 population and per capita gross domestic product, 1972 to 1978, in selected developing countries. *Source:* Scott A. Noll, "Transportation Energy Conservation in Developing Countries," RFF Discussion Paper D73K, 1982.

sumption of transport fuels and vehicle ownership will continue to rise rapidly, outstripping the increase in economic activity, and that the expected rise in prices of transport fuels will not be sufficient to moderate this trend significantly. Given the severe foreign exchange constraints faced by most developing countries, conservation of oil in the transport sector is likely to be high on the policy agenda. Taxes are one option—to make prices bite more severely. But for maximum effect, pricing policies need to be supplemented by, for example, improving the efficiency of the vehicle fleet and providing attractive alternatives to private cars.

Natural gas research program

On January 1, 1985, price controls on roughly half of U.S. gas production were lifted under provisions of the 1978 Natural Gas Policy Act. As predicted by RFF analysts and others, prices did not explode. Instead, the industry found itself facing a persistent glut of supplies and soft demand along with contractual rigidities, regional price disparities, and barriers to the effective use of transportation facilities.

The Federal Energy Regulatory Commission promulgated a Notice of Proposed Rulemaking intended to address these imbalances by promoting a regulatory regime more responsive to market forces. Announced after long and extensive public inquiry, the notice contains a number of provisions, including increased flexibility of contracts and broader access to transportation facilities, which have been central themes in RFF's research. These adaptations continued to be major focal points of work under the Natural Gas Research Program, despite a cut-the-budget cancellation by the Department of Energy of a contract to study these issues.

In an econometric analysis, Harry Broadman examined competition in pipelines' acquisition of gas supplies in wellhead markets. He finds little evidence that producer market power exerts significant upward pressure on field prices, but that pipeline market power significantly depresses field prices below competitive levels, with each percentage increase in pipeline concentration leading to roughly a 0.5 to 1.5 percent lower price, depending on the legal category of the gas. These findings provide strong support for initiatives to promote broader market access to transportation facilities to mitigate pipeline market power. Broadman's results also show how prices paid by pipelines for high-cost gas are inflated by the avail-

ability of "old," low-priced gas "cushions," thus illustrating the continuing market distortions of price controls on "old" gas.

A second study, by Michael Toman, assesses whether the flurry of short-term spot trading for natural gas is likely to persist after markets have adjusted out of current disequilibrium conditions. He concludes that the longer-term outlook for spot transactions in the interstate gas market is quite limited, with little more than 20 percent of gas volumes likely to be traded in this way. Among other implications, this conclusion raises questions about the viability of a futures market for natural gas.

Effects of coal policy

The J. Howard Pew Freedom Trust is supporting "Policy Affecting the Coal Industry," a two-year study to examine the effects of alternative federal policies in three major policy areas: coal leasing sales, railroad deregulation, and responses to acid rain. Both the direct effects on coal production, employment, and income as well as the indirect impacts on regional economies will be traced and estimated. The study will conclude by analyzing the policy implications of the results.

Contacts are being established with both private and public participants in the coal policy process, with information feedback and interaction an explicit goal of the work. Irving Hoch, now at the University of Texas at Dallas, is the principal investigator. Other participants include Winston Harrington, Hans H. Landsberg, Paul R. Portney, and Charles M. Paulsen at RFF, and Richard L. Gordon at the Pennsylvania State University. John F. Ahearne is RFF project manager.

Mineral economics and policy

Several mineral economics projects are heading toward publication, first among them Marian Radetzki's study of the impact on international mineral markets of production by state-owned or -controlled mining enterprises, especially in developing countries. Slated for publication in late 1985, the book deals with the alleged tendency of developing countries to pay no heed to market conditions but rather to produce as close to capacity as possible. Radetzki draws no robust conclusions, but he cautions that, while no clear evidence supports the conventional wisdom, there certainly are elements tending that way. The volume will both provide novel statistical background and raise appropriate issues in a debate

that is more timely than ever, given the poor economic position of the U.S. mineral industry.

A study of the economics of mineral exploration, supported by a grant from the Sloan Foundation, has been approved for publication. It provides quantitative information not previously available and attempts to establish and analyze trends. Mineral prices, equity-to-debt structure, lumpiness of investment in the wake of new geological findings and successes, favorable and unfavorable investment climates, and other factors are investigated for their impact on exploration decisions.

An investigation of the response of the world's major aluminum-producing areas (United States, Canada, Japan, Brazil, Australia, and Western Europe) is now in manuscript form. Of special interest is the diversity of responses, from a vigorous cutback in Japan's aluminum industry, to a valiant attempt in Western Europe to keep capacity inviolate through various direct and indirect government policies, to a strong expansionary trend in Brazil.

Funding is being sought for a broad-based research project on the causes of an observable flattening or downward demand trend for the major metals, not only in the United States but in all the industrialized countries and possibly in the developing and socialist countries as well. The project would identify the causes, area by area and metal by metal, and attempt to analyze their durability to gain some perception of the outlook. The World Bank has provided a small amount of funding, sufficient to initiate the research program.

The Mineral Economics and Policy Program has been conducted jointly with the Pennsylvania State University. It is directed by Hans H. Landsberg and John E. Tilton, who moved recently from Penn State to the Colorado School of Mines.

Atmospheric impacts of global development

With start-up funding from the U.S. Department of Energy and the National Aeronautics and Space Administration, and coordination by the Oak Ridge National Laboratory, a research team has begun a project to study the atmospheric effects of global development. The project will focus on three issues: key man-made activities and natural processes, their atmospheric emissions and the consequences of those releases, and policy issues posed by potential impacts. Examples of man-made activities include coal com-

bustion, pig iron smelting, transport, and fertilizer use, which release pollutants such as oxides of sulfur and nitrogen and particulates. An example of a natural process is the methane emitted from wetlands. Ultimately, the researchers plan to include a wide diversity of sources and effects—visibility, corrosion, acidification, ozone modification, climate change, smog. Given the need to assemble a substantial historical data base and test the feasibility of different modeling approaches, however, the initial phase of the project will be modest.

So wide-ranging an effort demands interdisciplinary capabilities. Accordingly, collaborating with RFF's Pierre Crosson and Joel Darmstadter are Robert U. Ayres, professor of engineering and public policy at Carnegie-Mellon University; ecologist William C. Clark of the International Institute for Applied Systems Analysis (IIASA), Austria; atmospheric chemist Paul J. Crutzen of the Max Planck Institute for Chemistry, West Germany; Thomas E. Graedel, also an atmospheric chemist, from AT&T Bell Laboratories; graphics analyst Robert McGill, also of AT&T Bell Laboratories; environmental historian John F. Richards, of Duke University; and Joel A. Tarr, professor of history and public policy at Carnegie-Mellon.

This undertaking is an outgrowth of Crosson's and Darmstadter's participation in a 1984 conference on the Sustainable Development of the Biosphere, held under the auspices of IIASA. They expect to maintain a close link with IIASA in its broad and continuing work in that area.

The economics of space

Outer space is a resource for a rapidly approaching future. Space is becoming the setting for new uses of satellites for communications and environmental monitoring, space shuttle activities that include manufacturing pharmaceuticals and metal alloys, and a planned space station to facilitate long-duration access to the advantages of a microgravity environment. These scientific developments are being accompanied by far-reaching social science questions, however, that address competing public and private interests in space as well as domestic and international concerns. For example, what are the respective roles of privately and publicly sponsored research and development? What are appropriate economic and institutional arrangements for the global environmental monitoring and earth remote-sensing systems now made possible by space-based tech-

nologies? What constitutes effective pricing policy for using the space station?

These and other questions make consideration of public policy toward space a timely and logical extension of RFF research. In keeping with this conviction, in 1984 RFF gave its first "Investment in People and Ideas" award to fund a study of space resources. Molly K. Macauley carried out this research (reported in an RFF discussion paper), which sought to identify the effect of regulatory policy on the nature of technical change in communications satellites. Regulations enforced by international and domestic agencies ration the use of two natural resources required for satellite technology—the electromagnetic frequency spectrum and the geostationary orbital arc. Research results suggest that rationing fails to reflect the true economic value of these resources. Consequently, the pace and direction of technical innovation in the use of the spectrum and arc may be more costly to consumers of satellite services, and to society as a whole, than if regulatory policy allowed a more market-like allocation of resources.

This finding has broader implications for other space activities, including the short- and medium-term economic benefits of the space shuttle in its role of launching satellites, and the development of substitutes for satellite communications, like fiber optic technology. Furthermore, recent congressional budget deliberations have challenged appropriations for federal space research, particularly in arc and spectrum use; levels of private-sector research under a different regulatory milieu may well be adequate. In addition, it appears that decision makers will need to coordinate more carefully the policies of different agencies (in this case, NASA and the Federal Communications Commission) as their responsibilities for space rapidly converge.

Detailed planning is now under way for another major RFF activity in space economics. With the National Academy of Engineering, RFF will be sponsoring a symposium in 1986 on economic and technical issues in space policy. The symposium will provide a unique opportunity for policy makers, industry representatives, and academicians to address the set of economic and engineering issues that govern debates on civilian use of space and the role of engineering and economic analysis in studying these topics.

SYMPOSIUM

The IAEA and nonproliferation

The International Atomic Energy Agency has two principal missions. It gives technical assistance to member countries that helps ensure their access to the peaceful benefits of nuclear energy. And, through monitoring the possible diversion of nuclear materials from civil nuclear facilities, it is the key component in international efforts to check the spread of nuclear weapons.

As part of RFF's multifaceted program examining the IAEA's nonproliferation role, a symposium was held in Washington, D.C., in June 1985. Sponsored by RFF in cooperation with the Brookings Institution, the gathering attracted an audience of U.S. legislative and executive representatives, leaders of the academic and policy research communities, and more than thirty ambassadors and other diplomats.

Drawing on his recent study for RFF (see page 58), Lawrence Scheinman of Cornell University delivered the centerpiece paper at the symposium and Vice President George Bush delivered a featured address. Other major speakers included Juan Eibenschutz, subdirector, Federal Electricity Commission of Mexico, and Mohamed Shaker, deputy permanent representative of the Egyptian Mission to the United Nations.

Other speakers included John F. Ahearne, RFF vice president; T. Keith Glennan, RFF consultant and former U.S. representative to the IAEA; Count Wilhelm Wachtmeister, ambassador of Sweden to the United States; Jon Jennekens, president of the Atomic Energy Control Board of Canada; John H. Crimmins, former U.S. ambassador to Brazil and the Dominican Republic; and Gerard C. Smith, chairman of the U.S. Arms Control Association.

Proceedings of the symposium were published by RFF after the close of the program year.

For the past several years, a substantial portion of the division's research has involved estimates of the benefits associated with environmental regulations. This emphasis reflects the interests of staff members as well as the enhanced attention within the federal government being given the potential economic consequences of environmental and other forms of regulation. Accordingly, four major projects completed during program year 1985 had as their focus the benefits associated with improvements in water quality. Three of these were concerned with recreation benefits, while one concentrated on human health.

Nevertheless, staff interests extend well beyond benefit estimation, as illustrated by four new projects and an informal workshop. The new projects include the development of a research plan for the Bonneville Power Administration dealing with the mitigation of damages to fish and wildlife resulting from its system of dams and reservoirs; an ambitious study of production behavior in the economy using a highly disaggregated data base; substantial revision of a popular, nontechnical book explaining and analyzing U.S. environmental policy; and a major new study of the potential use of economic incentives and other policy tools to reduce the volume of hazardous wastes generated each year. The workshop dealt with the pros and cons of discounting lives saved in the distant future when making present-value calculations of the benefits and costs of environmental and other regulations.

Data lack stymies benefits work

The 1983 Annual Report describes research done previously for the Environmental Protection Agency on the benefits accruing to society via the effects of better water quality on freshwater recreational fishing. In an extension of that work, the same method (an example of the so-called indirect approaches that depend on actual choices rather than hypothetical responses to surveys) was to be applied to recreational boating in fresh and salt water; to swimming in natural water bodies, also both fresh and salt; and to marine recreational fishing. The essence of the method is the use of measures of availability of the key resource (fishable marine water area in relation to total land and water area for the case of marine recreational fishing, for example) as a predictor in regression equations for participation rate and intensity. To the extent that availability (a proxy for the cost of participation) explains variations in participation, changes

The Quality of the Environment Division is concerned with the management of air, water, and land pollution, and the conservation of natural and environmental resources. Special attention is given to the environmental consequences of energy development and use and to how public decisions affecting the environment are made.

in availability projected to occur as a result of pollution control imply changes in future participation (in days per year). When a willingness-to-pay value per day of participation in the activity in question is applied, the change in days is transformed into an estimate of benefits of pollution control accruing to society from that activity.

The extension from freshwater fishing to other activities proved to be difficult, and the method itself may be questioned, as explained below. The major problem is the lack of data on water availability by activity in both the pre- and post-pollution cases. Indeed, no comprehensive data on appropriate objective water quality indicators could be found, so a survey was carried out of the judgments of state officials on these questions. Using the resulting availability data, survey data on participation in the activities of interest and the method sketched above produced benefit estimates with disturbing characteristics. The earlier fishing work had resulted in a wide range of final benefit estimates depending on methodological choices, with no single choice being arguably best. An even wider range was observed here, but, even more troubling, the low end of the scale for all activities was firmly in the negative numbers. While one might argue that, for example, days devoted solely to boating or to swimming might decline as water quality improvements made more water bodies available for both boating and swimming, one would not expect the total benefits reflecting participation in both activities separately and jointly to decline. This, however, was the case.

A noteworthy implication of this work is that benefit estimation depends critically on data, particularly data and projections on the extent of pollution before and after assumed controls. But data on water quality simply are not available in this country and never can be produced for earlier times. Thus, there is a sense in which we can never assess the benefits of current water pollution control programs using these classic, indirect methods.

The research team on this project included Clifford S. Russell, William J. Vaughan, now with the Inter-American Development Bank, computer specialist Charles M. Paulsen, and research assistant Julie Ann Hewitt.

Questioning methodology

John Mullahy and Michael Hazilla joined Russell and Vaughan in the second major EPA project completed last year. They used a simulation

model of recreational decision making to examine the method used in the fishing, swimming, and boating projects just described with a focus on three questions about aggregation.

- Did using average availability figures (say, acres of water per acre of state area applied to every person from that state in the data set) create serious problems for the method?

- Could results from small-area case studies confidently be "blown up" or extrapolated for use in estimating total national benefits?

- Could the reverse procedure be used? That is, could national-level studies be used with data from a subnational area (state or region) to estimate benefits of a local change in quality?

The answers turned out to be yes, no, and no. First, while cost proxies based on availability, if measured correctly for each individual, do work as well as true distance-based prices, the use of the average for some large area produces enormous variation around the "true" value in the resulting estimates. In practical situations, then, when average availability necessarily is used, we cannot be sure whether or not the results are nonsense.

Second, either scaling up or scaling down—using equations estimated with data from one level at a different level of aggregation—introduces another difficulty. Again, one cannot know in practical cases how seriously to take the results.

Thus, this work implies further doubt about the practical usefulness of the classical indirect methods of benefit estimation. These methods are considered respectable in conventional wisdom because they ultimately rest on revealed behavior rather than statement of intention or desire, and they have been used to produce benchmarks against which results from newer methods, such as contingent valuation, were to be judged. But, faith in these classical methods may have been excessive, calling into question the benchmarks and making the job of judging newer methods that much more difficult.

Contingent valuation

Robert Cameron Mitchell and Richard Carson explored one of the newer, less-conventional approaches—contingent valuation or the direct elicitation of willingness-to-pay—in the context of water pollution control. They used the technique to estimate the benefits of improving the nation's freshwater bodies related to the goals mentioned in the Clean Water Act: water of sufficient quality for swimming, boating, and fishing everywhere. Using specialized survey research methods, Mitchell and Carson asked respondents directly how much they would be willing to pay for carefully specified improvements in environmental amenities. The forty-minute, in-person interviews were conducted by professional interviewers with a national sample of 813 individuals.

The contingent valuation method attempts to arrive at a total willingness-to-pay measure, capturing both recreational and nonrecreational or intrinsic benefits. The latter, which are difficult or impossible to measure using indirect methods, include what are known as option and existence values. For the direct approaches to be successful, however, a meaningful hypothetical market in the good must be created for the survey respondent during the course of the interview. This must be done in ways that all individuals can clearly understand.

The RFF questionnaire, which underwent considerable experimenting and pretesting, is the first to be used to obtain a national benefit estimate. Following preliminary questions, respondents were confronted with different hypothetical levels of water quality and asked how much they were willing to pay, each year, in higher prices and taxes, to maintain the nation's freshwater bodies at a level sufficient for boating only; to raise the minimum level so that all waters were fishable; and to raise the minimum level from fishable to swimmable. The respondents' values were probed in various ways to better understand their meaning and establish their validity.

The findings indicate that *potential* benefits of water quality improvements in the nation's lakes, rivers, and streams are large and in excess of the current costs of the program. An adjusted mean value of $242 per household per year was obtained for a hypothetical improvement from very low levels to levels of swimmable quality (see table). This translates into a best estimate of $20.3 billion a year in benefits, with a reasonable range of $19 billion to $30 billion. Although sizable, these benefits (which

Adjusted Annual Household Values for Best Estimate of Willingness-to-Pay for Water Quality Levels
(dollars per year)

Level of quality	Mean	Standard error of the mean	95% confidence interval
Boatable	94	8	77–109
Fishable	70	6	58–82
Swimmable	78	9	60–96
TOTAL	242	19	205–279

exclude commercial-use benefits) are less than current estimates of the increase in expenditures necessary to reach the swimmable quality goal.

The data also show that most of the potential benefits could be realized if the current national water quality goals were modified by designating a few waterways as industrial, allowing them to remain at the boatable quality level, and by setting a national minimum water quality goal for the remainder of the nation's freshwater bodies at slightly below the swimmable level. In this case, at least, the public appears to understand the nature of marginal benefits.

Mitchell and Carson's work also was sponsored principally by the Environmental Protection Agency.

Benefits of avoiding giardiasis

Research at RFF on the benefits of environmental regulation involved a more immediate problem in 1984 after the Environmental Protection Agency concluded that the protozoan *Giardia lamblia* was a threat to some public water supplies. Although seldom fatal, giardiasis can be a highly unpleasant gastro-enteric disorder characterized by diarrhea, abdominal cramps, weight loss, fatigue, anorexia, and nausea lasting a period of several days to several months. Between 1965 and 1982, fifty-four waterborne outbreaks of giardiasis were reported to the Centers for Disease Control in Atlanta.

Under the Safe Drinking Water Act of 1974, EPA is required to establish drinking water regulations where contaminants may have an adverse effect on public health. Before proceeding with such a regulation, EPA initiates research on the costs and benefits of mandating specific water treatment

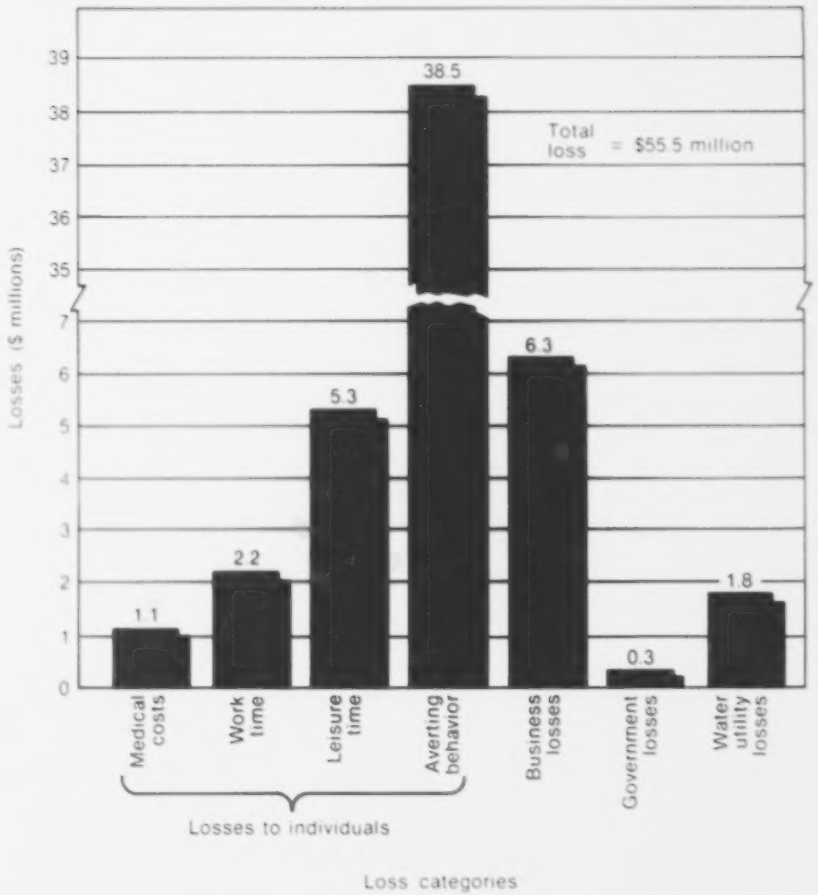
technologies. As part of that research, EPA asked Walter O. Spofford, Jr., Alan J. Krupnick, and Winston Harrington to develop methods for estimating losses from giardiasis and to apply those methods to estimating the benefits of avoiding a known outbreak of the disease.

For their case study, Spofford, Krupnick, and Harrington chose the 1983–1984 outbreak of giardiasis in Luzerne County, Pennsylvania, which lasted nine months, involved 370 physician-diagnosed cases of giardiasis and up to 6,000 suspected cases, and affected an exposed population of 75,000 people and many businesses and institutions in eighteen communities.

The researchers estimated losses to individuals based on a utility-maximization model of willingness-to-pay to avoid illness caused by contaminated water. This model identifies four types of losses: out-of-pocket medical costs, productivity losses, leisure time losses, and pain and suffering. In addition, it identifies losses due to averting behavior, including costs of obtaining an alternative supply of drinking water and the consumer surplus lost from consuming less drinking water. Losses to businesses are measured as the sum of the losses in producer and consumer surplus, and losses to government agencies are measured as the value of time government officials spent on the outbreak, using government wage rates. Finally, expenditures made by the water supply company to reduce the risk of contamination are used to measure its losses.

Each of the 370 confirmed cases was sent a questionnaire, and a random telephone survey of households in the area determined defensive strategies residents used to avoid the disease. Separate questionnaires were sent to restaurants and bars and to government officials, and both personal and telephone interviews solicited data from hospitals, dentists, day care centers, and other businesses and institutions likely to be affected. The public record of the Pennsylvania Public Utility Commission provided the cost of temporary measures taken by the water supply utility to provide a safe supply of water.

Estimates of the total giardiasis-related losses range from $9 million to $56 million, or from $120 to $747 per person residing in the affected area. The estimates vary depending on the value assigned to the additional time people spent avoiding exposure to the disease and to the leisure time lost due to illness, as well as on the categories of losses included in the es-



Estimated losses due to the outbreak of giardiasis in Luzerne County, Pennsylvania, in 1983–1984, by major loss category—high estimate. *Note:* Business Losses include out-of-pocket costs, lost profits, lost consumer surplus, and losses from reduced employee productivity.

timate. The distribution of losses among categories of losses for the largest estimate is depicted in the accompanying figure. As shown, losses incurred by individuals to avoid the disease dwarf the losses both from illness and those incurred by business.

Fish and hydropower

In the middle and late 1930s, several large dams and powerhouses were created on the main stem of the Columbia River, in part to provide employment and other economic stimuli during the Great Depression. Rock Island Dam, a Public Utilities District dam, was completed in 1933, and the much larger federal Bonneville and Grand Coulee dams in 1938 and 1941, respectively. As it became apparent that an agency would be needed to transmit and market the large amounts of hydroelectricity to be produced, in 1937 Congress passed the Bonneville Project Act creating the Bonneville Power Administration (BPA). Fortuitously, a large market for electricity developed quickly, primarily in the electrometallurgical industries that produced aluminum for aircraft construction during World War II. After the war, electrical demand in the Pacific Northwest grew steadily and rapidly until recently, and hydropower simultaneously developed on a very large scale.

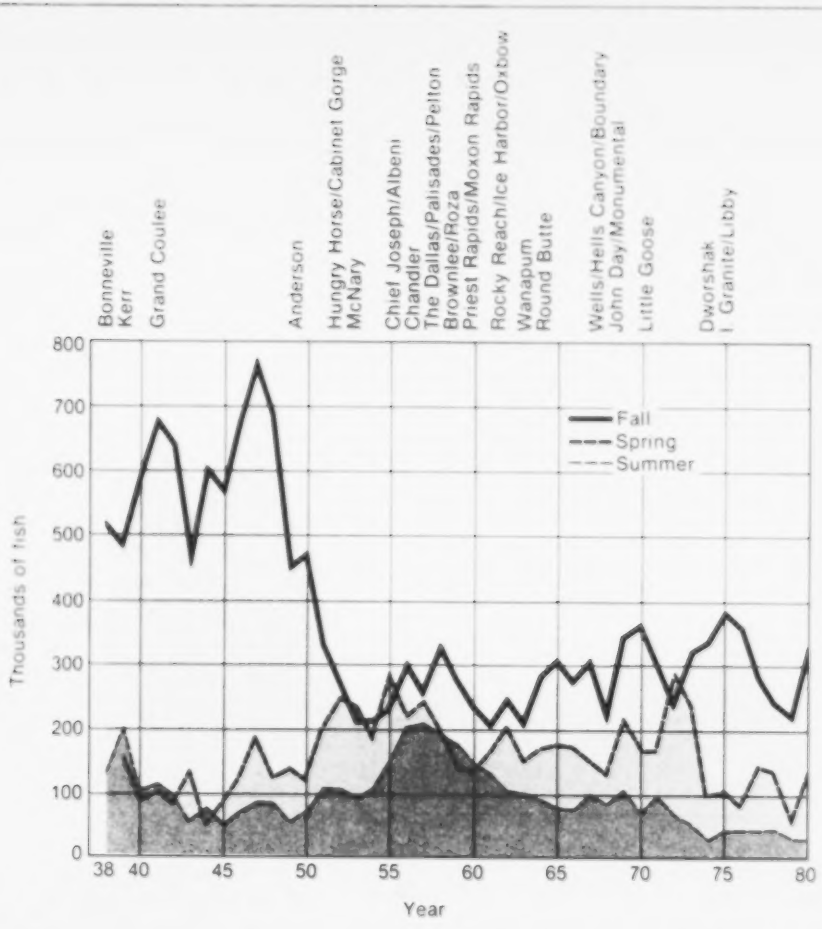
The Federal Columbia River Power System, completed in 1975, consists of twenty-eight dams producing more than 13,000 megawatts of power and containing 20 million acre-feet of storage capacity. Counting other large public and private utility dams and federal and state dams for flood control, there are more than fifty major dams in the Columbia system.

This extraordinary river basin development produced many benefits for the Pacific Northwest, including the nation's least expensive electric power. But it also imposed environmental costs. Along with other developments, like forestry practices and deep ocean fishing for salmon, it seriously hurt the enormous salmon runs on the Columbia River system. The accompanying map shows the dams that currently affect the salmon runs in the mainstem of the Columbia and Snake rivers. Damage occurs to the young fish (smolts) migrating to the sea (when they pass through electric power turbines, for example) and to adult fish returning to spawn (when they attempt to surmount dams, for example). Exacerbated by drought, by the late 1970s the decline of the upriver runs had become so severe that it became a cause for concern by residents and organized interests in the

Dams that currently affect salmon runs in the mainstem Columbia and Snake rivers. Source: Fisheries agencies and tribes.

Pacific Northwest and their representatives in Congress (figure). This was one of the reasons Congress passed the Pacific Northwest Electric Power Planning and Conservation Act in 1980. Among its terms is a requirement that BPA fund, through levies on its rate payers, measures to mitigate damage to fish and wildlife caused by the federal hydropower system. Of utmost concern are the salmon runs.

At BPA's request, RFF has launched a project to plan a program of BPA-sponsored research that would aid its administrator and other responsible agencies in the region in the conduct of the mandated mitigation efforts. A central objective of the research planning, directed by Allen V. Kneese,



Estimated numbers of upriver Chinook salmon in runs entering the Columbia River, 1938–1980, and major dams in the Columbia System by year of completion. Source: Fisheries agencies and tribes.

is to define an analytical system that would help determine fish losses caused by the development of the federal hydropower system as distinct from, say, forestry practices or overfishing. Once the loss is defined, the research results should help allocate it to specific facilities and, where they are multiple-purpose, to specific purposes, such as hydropower or flood control. Further purposes are to help determine cost-effective measures for mitigation and to provide both biological and economic information to assist in setting the goals of the mitigation effort. The research planning project, begun in September 1985, is scheduled to continue for twenty-six months.

Other principal researchers involved are Clifford Russell, Walter Spofford, and the University of Maryland's Virgil Norton.

Microeconometric analysis of producer behavior

Many important public policy issues revolve about the production of goods and services in the economy. A partial list includes slowed productivity growth, dangerous industrial pollutants and toxic substances, aging capital stocks, dependence on foreign supplies of energy and critical minerals, consequences of the many forms of governmental regulation, and increased competitiveness of world markets. Informed decision making regarding these issues requires a comprehensive understanding of production activity and industrial organization at a level of sophistication far greater than previously attained.

Raymond J. Kopp and Michael Hazilla have begun a program of research premised on the belief that prior understanding of these issues has been limited by reliance on aggregate data and a theoretical approach that views all firm responses as homogeneous. Case studies of individual firms and production establishments reveal enormous heterogeneity even in narrowly defined industries and highlight the discrete nature of many firm decisions when viewed at the plant level. Unfortunately, while case studies point out the weaknesses in aggregate analyses, their usefulness is limited by inability to generalize from case-study results. Kopp and Hazilla's response to this dilemma is a program of basic and applied research that will utilize and extend neoclassical economic theory and econometric techniques designed to examine, in a general framework, the continuous and discrete decisions made by individual economic agents. This general theory is incompatible with data aggregated over plants, firms, or regions;

thus, the applied research is based on data describing economic behavior of producers at the establishment level.

The foundation for the applications data base is the Longitudinal Establishment Data (LED) file maintained by the Bureau of the Census and a cooperative agreement between RFF and the Center for Economic Studies at Census that provides for the logistical link to the confidential data files. In its present form, the LED is a pooled time series of cross sections of establishment-level annual data from 1972 to 1982. The time-series nature of the file permits examination of some 25,000 of the nation's largest manufacturing establishments on a continuous basis over the eleven-year interval, while the three census years in the sample open to examination roughly 350,000 establishments in 1972, 1977, and 1982.

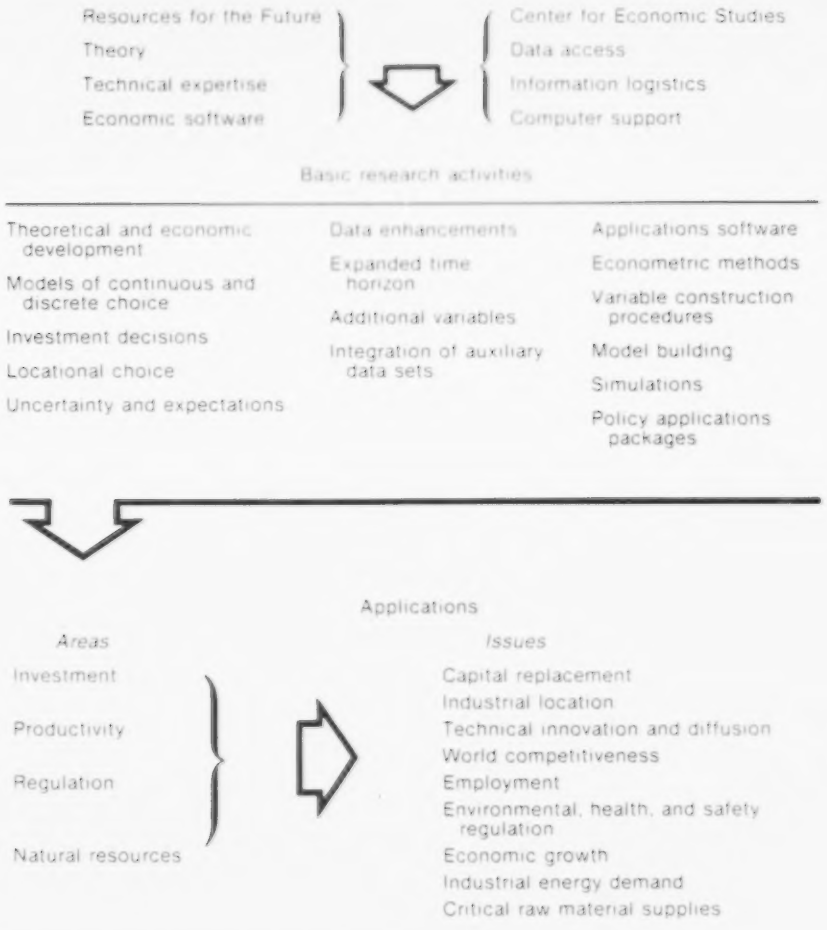
This combination of extended theory, a broader menu of econometric techniques, and the unique data base will provide a foundation for a projected multiyear program of research into the production and investment relations of the U.S. economy. A sketch of the program's major anticipated activities and issues is provided on the next page.

Kopp and Hazilla's initial analysis of producer behavior is sponsored by the National Science Foundation.

Current Issues in U.S. Environmental Policy

In 1978 RFF published *Current Issues in U.S. Environmental Policy*, edited by Paul R. Portney and including contributions by him and others. Explaining and analyzing in nontechnical language the major environmental laws and policies, the book found wide use in classrooms and has proved a valuable reference for the business community, members of Congress, and interested citizens; its sales approach 10,000.

But a number of developments have taken place in the environmental field since *Current Issues* was compiled. For example, in 1980 Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act, better known as Superfund, to address the problem of abandoned hazardous waste disposal sites. Moreover, two 1976 statutes—the Toxic Substances Control Act and the Resource Conservation and Recovery Act—have begun to occupy more and more of the EPA's attention, further shifting the focus of environmental policy away from conventional air and water pollution problems and toward the seemingly more exotic threats associated with toxic substances in the air, water, or land. When



The microeconometric analysis of producer behavior.

coupled with the "new" problems of acid rain, indoor air pollution, victim compensation, and others, this suggests the need for a fresh look at environmental policy.

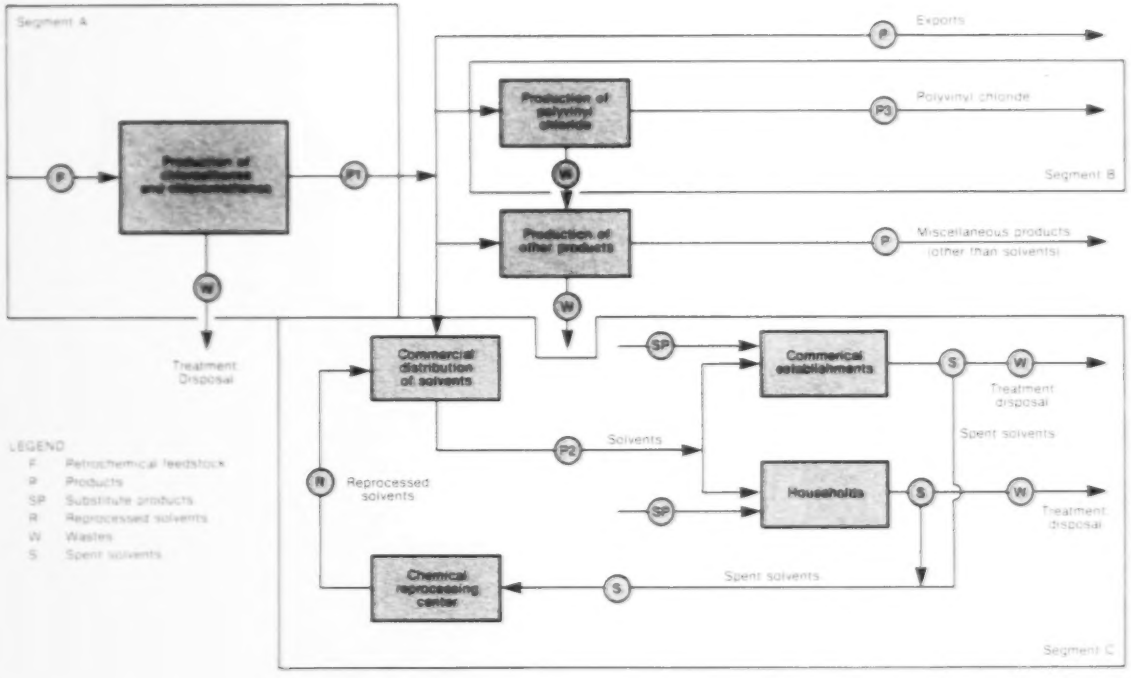
Accordingly, in the spring of 1985, with the support of the Esther A. and Joseph Klingenstein Fund, Portney and others began work on a new and substantially revised version of *Current Issues*. In addition to descriptions and analyses of new laws and regulatory policies, the book will review continuing developments in existing policy areas, including the use of economic incentives in pursuit of environmental quality. It will also present fresh information on the costs and benefits associated with environmental regulations. New chapters include ones on hazardous wastes (by Roger Dower, Environmental Law Institute), monitoring and enforcement (Clifford Russell, RFF), and emerging issues in environmental policy (Portney). The book also will include chapters on water pollution (A. Myrick Freeman, Bowdoin College), toxic substances (Michael Shapiro, EPA), and air pollution (Portney). Publication is planned for mid-1986.

Reducing hazardous wastes

In a project directed by Walter O. Spofford, Jr., general propositions and technical possibilities for reducing the generation of hazardous wastes will be demonstrated by a case study of production and hazardous waste generation in the chloroethanes-methanes chemical industry (figure). At the center of the project is the extension and application of a process flow model of this industry. The basic model, available through EPA, was developed under EPA contract by Industrial Economics, Inc.

Spofford plans a three-year effort involving three major phases. In the first, alternative incentive structures will be delineated and their properties assessed. These may include taxes on primary feedstocks, feedstock derivatives, certain chemical products, and on waste-end "products," subsidies through favorable depreciation allowances, and deposit-refund systems.

In the model extension and restructuring phase, new process alternatives will be added to EPA's model of the chloroethanes-methanes chemical industry when sufficient information is available in the literature, in patent applications, and from industry to develop these alternatives. Also, hazardous wastes generation coefficients will be added to the model to



Schematic diagram of the chloroethanes-methanes industry showing production, waste generation, and use of products.

provide the needed relationships between products, by-products, and waste streams from production processes, and the commercial chemicals and waste streams classified as hazardous by EPA under RCRA, the Clean Water Act, and the Clean Air Act. And the model will be restructured, as necessary, to respond to the incentives designed in the first phase. This second phase may include extensions to processes for the manufacture of substitute products.

The policy analysis and design phase will have two parts: the restructured and extended model will be configured and calibrated to representative plants in the industry, or to individual plants or groups of plants in the industry; and run with alternative regulations and economic incentives to explore differences in the generation of hazardous wastes (and other characteristics of production processes), differences in the costs of achieving various levels of waste reduction, and the distribution of these costs among products and processes. In this phase, researchers will assess the effects on the production of chemicals and substitute products outside the chloroethanes-methanes industry of changes in the demand for chloroethane-methane commercial products. For this assessment the project will rely on EPA's ongoing study of organic solvents.

The project is intended to make both methodological and practical contributions to the public debate over hazardous materials management. On the methodological side are a systematic review and extension of incentives designed with several facets of the hazardous waste problem in mind: generation reduction, adequate treatment and safe disposal, difficulty of monitoring disposal behavior, and the potential for scavenging by third parties of improperly disposed wastes. In addition, the project will explore the usefulness of industrial process models for analyzing the implications of alternative incentives in hazardous waste management.

On the practical side, the researchers will establish the effects of a variety of incentives and originate information on reductions in the generation of wastes, the costs of these reductions, and side effects (such as the use of substitute products). In addition to Spofford, the RFF research team includes Clifford Russell, organic geochemist Philip H. Abelson, RFF Natural Science Fellow and former editor of *Science* Magazine, who will serve as a consultant; computer specialist Charles Paulsen; research as-

sistant Margaret M. David; and a chemical engineer to be employed. The project is sponsored by the A.W. Mellon Foundation.

WORKSHOP

Discounting future lives

In September 1985, Paul Portney and Clifford Russell hosted an informal workshop designed to allow policy makers to exchange views with each other and with academics on the controversial question: Should discounting be applied to estimated future changes in life expectancies caused by public policies? The expectation was that the workshop would see the airing of a fundamental disagreement on the issue between the Office of Management and Budget—known to favor such discounting—and the federal regulatory agencies, especially the Environmental Protection Agency, which the media had painted as opposed.

Attending were fifteen agency representatives, including individuals from the Consumer Product Safety Commission, Office of Management and Budget, Federal Trade Commission, Commerce Department, Occupational Safety and Health Administration, and Environmental Protection Agency. There was one staff person from Congress, as well as two representatives from other research organizations and two consultants.

The workshop began with three brief presentations. In the first, Robert Dorfman of Harvard stressed that as long as there was the option of postponing an investment in life saving by one or more periods, and if during that time interest could be earned on the money not spent, the result for cost-benefit calculations was identical to the application of a discount factor to future statistical lives "saved."

The second presentation, by Douglas McLean, director of the Center for Philosophy and Public Policy at the University of Maryland, began with his assertion of the moral equivalence of a life saved 100 years from now and one saved tomorrow. He then critiqued six arguments for discounting future changes in life expectancies and found most of them wanting. Significantly, however, one justification emerged relatively unscathed. If opportunity costs are involved in the life-saving activities, McLean was willing to admit that discounting was justified. As this echoed Dorfman's

argument, there appeared to be an important element of intellectual agreement.

Portney addressed several practical considerations surrounding the discounting issue. He suggested that compounding costs until the (future) date at which lives are saved, while equivalent to discounting the number of lives saved to present values, may be more politically palatable.

Whether because the agency representatives were not those cited in media reports or because those reports had been exaggerated, there also seemed to be agreement among the policy makers on the desirability of discounting statistical lives or life years. No clear objection to this position was voiced by any of the participants. (The congressional staff person did remind the group that Congress found it politically difficult to deal with such an idea and might balk at allowing it if the issue ever arose in that form in the legislative process.)

Given the level of agreement in principle and among the policy makers, it might seem surprising that the workshop concentrated on argument and controversy. But most of the time after the presentations was spent in attempts to narrow the gap between McLean and the others on the morality of discounting lives saved in the distant future. However, the discussion was instructive to all because it forced some hard thinking about what exactly had to be accepted or assumed to justify the discounting that all appeared ready to do. Participants from the government seemed to agree, moreover, that RFF was a hospitable neutral ground upon which to discuss issues arousing passions within federal agency walls.

Work on water—both its availability and its quality—highlights the year's accomplishments. The first project described below examines the growing scarcity of water not only in the arid western United States but also and more surprisingly in the well-watered East. The second details findings on agricultural sources of water pollution.

One area of focus within the Forest Economics and Policy Program was international trade, and specifically U.S.-Japanese trade in forest products. Just beginning are two approaches to the threat to biological diversity posed by the destruction of tropical forests.

The second year of operation for the National Center for Food and Agricultural Policy saw considerable progress on international trade issues, on the determinants of agricultural productivity growth, and on projects pursued by four outside scholars who were in residence during the year. In addition, the national center's ambitious program of conferences and workshops resulted in five events, each of which is described briefly.

Solving long-term water problems

The nation's complacency about the availability of good quality, inexpensive water is being challenged as evidence of scarcity mounts and concern spreads about the adequacy of supplies. Indeed, water use exceeds renewable supplies throughout much of the West's better agricultural areas, and even in the relatively water-rich areas of the Columbia River basin and parts of the humid East conflicts over the rights to streamflows have become common. Not only are the costs of developing new supplies rising, but also the traditional, structural approach to resolving water problems often exacerbates rather than resolves conflicts between instream and offstream water uses. New approaches are needed that consider demand as well as supply.

A recently completed study, directed by Kenneth D. Frederick, uses five case studies to explore alternative ways to resolve long-term water problems. Broad issues addressed include the role of institutional factors such as water laws and administrative arrangements in creating and solving a region's water problems, the factors that affect a region's ability to respond to changing supply and demand conditions, and the potential use of markets and prices for allocating supplies and creating incentives for conservation.

The Renewable Resources Division conducts research on integrated management of the land, including studies of food and agriculture, forestry, fresh water, and land use. It seeks knowledge of natural and human resources and an understanding of impacts of nature and people on both the resource base and human welfare.

The first four case studies focus on areas encountering major problems allocating scarce supplies among competing uses and meeting projected needs. In the Columbia River basin a thirty-seven-fold increase in the value of water for hydropower over two decades underlies the emergence of conflicts between hydropower users and irrigators, who traditionally enjoyed free access to water to develop new irrigated lands. Walter R. Butcher, Philip R. Wandschneider, and Norman K. Whittlesey of Washington State University examine how technical and economic factors produced such major changes in the relative instream and offstream values of water in the Pacific Northwest, assess the adequacy of the region's institutions for dealing with these changes, and recommend needed reforms.

The continued prosperity of predominantly agricultural Kern County, California, depends on how well it adapts to the increasing scarcity of water. Henry J. Vaux, Jr., of the University of California, Riverside, concludes that water trades among the county's various water districts and with other areas of the state offer the best hopes for keeping water costs low and procuring additional supplies. He discusses measures that might make such trades possible.

Richard W. Wahl and Robert K. Davis, both of the U.S. Department of the Interior, focus on southern California, which is threatened with the loss of major supplies of imported Colorado River water. The least costly and most efficient means of narrowing the gap between projected demand and supply involves managing demand, while the two least expensive alternatives for adding to supplies would require institutional changes permitting purchases of water from others within the state.

Virginia Tech's Leonard Shabman and William E. Cox analyze the situation in the Virginia Beach metropolitan area, a rapidly growing area where many residents believe water imports are essential to continued growth and prosperity. Institutional shortcomings and conflicts among neighboring political jurisdictions have led Virginia Beach to seek additional water at higher cost through an interbasin transfer. Despite an apparent abundance of water in the exporting basin, the import alternative is opposed by North Carolina and poses its own institutional obstacles.

The final case study by Charles W. Howe, Dennis R. Schurmeier, and William D. Shaw, Jr., all of the University of Colorado, examines the

development and operation of the Colorado-Big Thompson project. This project involves an innovative institutional arrangement in northeastern Colorado that has facilitated the transfer of water among uses in response to changing conditions and offers insights into the types of arrangements that might make water use more efficient in other areas as well.

In an overview, Frederick outlines the principal factors influencing how the nation uses and abuses its waters, summarizes the principal issues addressed in the case studies, and draws broad lessons regarding the nature of U.S. water problems and the ways to resolve them.

Because understanding the value that various water uses contribute to society can illuminate the implications of alternative water policies and institutional arrangements, Diana C. Gibbons has examined the methodologies for estimating water values and surveyed a wide literature providing estimates of the value of water in various uses and locations. The Gibbons study and the case study volume, both of which will be published by RFF during the coming year, were supported by the William H. Donner Foundation, Resources for the Future, and the General Service Foundation.

Agricultural sources of water pollution

Federal agencies have become increasingly concerned about agriculture's effect on water quality, and with good reason: cropland alone accounts for roughly a third of the annual loadings of pollutants such as phosphorus, nitrates, and suspended solids. The three agencies most concerned with the problems of agriculture's relationship to water quality—the Department of Agriculture, the Environmental Protection Agency, and Interior's Geological Survey—recognize the need to understand better how agricultural activity affects water quality, often many miles downstream. Without this understanding, it is impossible to develop effective policy.

Accordingly, these agencies asked RFF to apply its data bases, models, and analytical techniques to the question of determining where agricultural pollution is most significant, where controls would be most effective, and which policies would be least costly. The first phase of this multiyear effort has been completed by Pierre R. Crosson, Leonard P. Gianessi, Henry M. Peskin, and Cynthia Puffer. They reach three principal conclusions.

First, while agricultural pollution problems may be widespread, policies will be more efficient if they are targeted toward selected regions. For

The shaded areas on this map indicate the relatively few areas where controls on sediment from cropland can lead to significant improvements in water quality as measured by phosphorus concentrations.

example, the shading on the accompanying map indicates the relatively few areas where controls on sediment from cropland can lead to significant improvements in water quality as measured by phosphorus concentrations. Clearly, cropland controls applied nationwide leave water quality in most regions improved only marginally with respect to the standards and usually well below them. This seeming anomaly has two explanations. In a few regions water quality already is acceptable. In others, the quality is poor, but it often is made so by noncropland sources, like natural streambank erosion. In either case—improving the already acceptable and improving the unacceptable to a point well below standards—erosion controls would have relatively little payoff. Instead, attention should be directed at those regions where policies would make a difference.

Second, the effects of controlling one source of pollution depend on whether other sources will be targeted. For example, in many regions cropland controls will not improve water quality to acceptable standards unless other sources, like rangeland and forestland, are also controlled. Third, because of water's ability to transport pollutants long distances, it will be necessary to control certain regions that have no pollution problems of their own.

In addition, a report by the research team suggests some alternatives to the current focus on the farm as a target of controls. In certain instances, for example, it may be far more efficient to intercept the pollutants closer to the water bodies where they do damage. These points of interception, such as on small streams, need not be located on the farms where the pollution originates. In general, the report recommends that the drainage basin, rather than individual farms in the basin, should be the focus of policy.

Finally, the researchers urge that policy recommendations incorporate better information on the costs of alternative control policies and the social value of improved water quality. These issues, as well as improvements in the data base and model structure, will form the core of the project as the research continues.

Barriers to forest products trade

Concern over the U.S. trade deficit has generated considerable interest in the extent to which tariffs and nontariff barriers discourage exports. In this regard, Roger A. Sedjo has completed a study of U.S.-Japanese forest products trade, funded by the Reischauer Center of the School of Advanced International Studies of the Johns Hopkins University and prepared for the President's U.S.-Japan Advisory Committee, chaired by David Packard.

U.S. forest product exports to Japan annually exceed $2.5 billion—roughly $1.9 billion in solidwood products and $0.6 billion in pulp and paper products. Sedjo found that while Japan is a heavily forested country, it gradually has been importing a greater portion of its domestic wood resource requirements, with the vast majority of its imports in the form of unprocessed or lightly processed wood. The study found several reasons for this structure of imports.

Japan uses a different construction technique for housing and therefore

its lumber standards differ from those of North America. Also, the Japanese distribution system is difficult and complex. For example, newspapers do not maintain their own inventory of newsprint; rather, the supplier has the obligation of prompt and timely delivery even under difficult circumstances. Thus, a long-term relationship built on responsibility and trust is required. However, in addition to these cultural reasons for the Japanese import structure, Sedjo established that Japan does tend to have somewhat higher forest product tariffs than do other industrial countries, as well as a more extensive set of nontariff barriers.

In a related effort, visiting scholar I. J. Bourke, of the New Zealand Forest Research Institute, has begun work on a study of nontariff barriers in forest product trade. Bourke was awarded the prestigious Andre Mayer Fellowship by the UN's Food and Agriculture Organization, and the FAO selected RFF to house him while he conducts his research. His effort is directed at identifying and analyzing the major nontariff barriers that are inhibiting forest product trade, particularly as they apply to trade from developing to industrial countries.

Forests and biological diversity

Concern is growing about the extent to which tropical forests are being destroyed, in major part because of the belief that deforestation is causing large-scale losses of species and narrowing of biological diversity.

Two new and complementary efforts are currently under way that address this issue. Ronald A. Foresta, 1980 Gilbert F. White Fellow at RFF and a newly arrived forestry fellow, is examining the process of policy development and formulation that is establishing protected natural areas in the Amazon. Among the questions Foresta is pursuing: What factors make this an international public issue? What is the relationship between the scientist and the policy maker? And what is the nature of the industrial countries' role in this process?

In the second related effort, Roger Sedjo is examining biological diversity as an economic resource. In what ways are genetic resources unique so that normal market mechanisms fail to protect them adequately? Sedjo is analyzing the relationship among property rights, uncertainty of future values, institutions, and optimal preservation of diversity, and trying to establish the social value of biological diversity and the considerations that determine the optimal level of forests to maintain biological diversity.

The Forest Economics and Policy Program is directed by Roger Sedjo and funded in large part by generous grants from the Weyerhaeuser Company Foundation and the U.S. Forest Service.

NATIONAL CENTER FOR FOOD AND AGRICULTURAL POLICY

The national center, headed by Kenneth R. Farrell, studies interrelated public policy issues involving agriculture, food and nutrition, international trade, natural resources, and environmental quality. It was established in January 1984 with a five-year grant from the W. K. Kellogg Foundation.

During its second year the national center made considerable progress in establishing its major programs and hiring a core staff to carry them out. Several projects and conferences are described below.

National policies and international trade

Rising tensions in agricultural trade have focused attention on the close relationship between the domestic and international agricultural policies of the major industrial countries. Current deliberations in the General Agreement on Tariffs and Trade recognize that mutually agreed reductions in agricultural protectionism cannot be effective by concentrating exclusively on import restrictions and export subsidies; the domestic policies, which are at the root of the problem, also must be addressed.

Agricultural policies have resisted change because they are deeply entrenched in national legislation or, in the case of the European Community, in international agreements arrived at with great difficulty. However, the logjam may be breaking now that budgetary concerns have led to a thorough reexamination of these policies in the United States and abroad. Consensus is growing that present price-support policies are not achieving their objectives, and the objectives themselves are being questioned in view of structural changes since they were conceived. This situation offers a chance, in the forthcoming round of multilateral trade negotiations, to reduce trade barriers, export subsidies, and other distortions of agricultural trade.

Encouraged by consultations with scholars and nonprofit research institutions in Europe, North America, Japan, and Oceania, the national

center has launched an international project to reassess national policies and their implications for trade and to distill lessons and conclusions that may be useful to policymakers. Conducted by Fred H. Sanderson with Rachel N. Sarko's assistance, the project will convene a number of workshops with scholars from the various regions and will culminate in a book, an international conference, and policy briefings with policymakers and private-sector leaders.

Agricultural productivity

Recent research at the national center reveals that total factor productivity in U.S. agriculture has grown at an average annual rate of 1.6 percent since World War II. Despite that growth and current high levels of output, many observers are concerned about the future course of productivity and the long-term productive capacity of U.S. agriculture to meet expanding demand for food and fiber. To address this concern, the national center in 1984 began a project to measure productivity growth in the U.S. agricultural sector, with an emphasis on the major determinants of that growth. Supported largely by the Rockefeller Foundation, the project's principal objective is to provide information and guidance on the effects of alternative policy options to maintain or enhance future productivity growth.

During 1985 project director Susan M. Capalbo and research assistant Trang T. Vo focused on empirical analysis of productivity change since World War II. Two levels of analysis have been pursued, beginning with a review of the methodologies and results of previous and ongoing analyses of productivity. The primary goal of the review is a synthesis of past models of productivity for reference in specifying and modifying the analytical basis for more in-depth productivity analysis and projections.

Second has been a reestimation of aggregate productivity relationships, drawing on recent advances in the methodology for decomposing and identifying sources of growth-rate changes. Neoclassical production models have been estimated to measure parametrically total factor productivity. Two distinct components of observed changes in total factor productivity have been isolated: technological progress and returns to scale, with the former accounting for the lion's share of productivity growth in agriculture. In particular, technological change has been labor-saving and chemical- and capital-using. Scale changes have contributed only a small portion of the observed growth in productivity.

In addition to the aggregate analysis, productivity changes for selected regions and countries have been studied. Regional estimates for corn and soybean production in Illinois, Indiana, Iowa, Missouri, and Ohio in 1974 and 1978 suggest substantial gains in total factor productivity of corn and soybeans in all states, with Iowa leading the way in the production of both crops.

Analysis and comparison of the United States and Canada indicate that both total factor productivity (TFP) and labor productivity grew more rapidly in Canadian agriculture from 1962 to 1978. The annual rate of growth in Canadian TFP exceeded U.S. productivity growth by roughly 1 percent. During the 1960s labor productivity growth was similar in the two countries.

Resident fellows

Margaret S. Andrews spent the 1985 program year investigating the underlying political and economic determinants that define the turning points in the nature of government's intervention in agriculture. Identifying these determinants will provide insights into current and future U.S. farm policy debates. But the research also has potential implications for the larger debate among development economists concerning why the more advanced industrial countries tend to overvalue politically their farm sectors while the poorer capitalist countries typically undervalue their agriculture with cheap-food policies that benefit urban residents.

Katherine L. Clancy's major project while in residence was defining the public interest in food and nutrition, in part to develop possible elements of a policy analysis and education and information program for the national center. Her study includes an overview of the nutritional status of the population, the changes in the food system that contribute to nutrition and health, and some of the factors likely to have the greatest effect in the near future.

Much economic analysis of food and agricultural policy deals with such a limited problem that decision makers and concerned citizens find the analysis of little use in formulating alternatives, making decisions, and implementing solutions. Glenn L. Nelson argues that more attention should be given to theories of distributive justice based on rights. In a forthcoming essay he will outline alternative philosophical positions growing out of the contractarian and libertarian positions. The empirical part of his re-

search will examine the norms in the discussion of the 1985 food and agricultural legislation, including a comparison with historical periods.

Gordon C. Rausser spent his partial year at the national center studying the differential impact of macroeconomic policies versus sector-specific policies on the performance of the U.S. food and agricultural system. He found that macroeconomic policies—tax, fiscal, and monetary policies, for example—can easily dominate the short-run effects of agricultural policies per se on the price and income paths of U.S. agriculture. Agricultural policies can modify, but not change, the basic direction established by macro policies.

Rausser also prepared (with William E. Foster) a comprehensive assessment of the many conferences and studies preparatory to the 1985 farm bill. This is included in the national center's *Annual Policy Review 1985: The Dilemmas of Choice*.

CONFERENCES AND WORKSHOPS

Policy choices 1985

In advance of congressional hearings on the 1985 farm bill, in December 1984 the National Center for Food and Agricultural Policy sponsored a national conference, "Food, Agriculture, and Resources: Policy Choices 1985," with the National Agricultural Forum and seventeen cosponsors. The two-day conference, held in the Washington, D.C., area, was attended by 325 people, including national officials, business and academic leaders, and members of policy research institutions, general farm organizations, and commodity, resource, and environmental groups. Several of the major papers delivered at the conference form the core of the first of an annual series of policy reviews to be published by the national center. *Annual Policy Review 1985: The Dilemmas of Choice* was published by RFF in October 1985.

New technology

"Food and Agriculture Forum on New Technology: Driving Force in the Food System" was sponsored by the Food and Agriculture Committee of the National Planning Association, the Greater Des Moines Chamber of Commerce, and the national center. Held in Des Moines, Iowa, on November 4, 1984, the conference featured national center director Kenneth

Farrell, who spoke on "Reassessment of Global Food Prospects: The Essential Role of Technology."

Training consumer leaders

The national center joined with Public Voice for Food and Health Policy to stage a leadership training workshop, "Building Consumer Participation in Food and Agriculture Policy." Held in Washington, D.C., on January 14 and 15, 1985, the workshop was designed to improve the participants' understanding of the importance of the 1985 farm bill. Thirty-two consumer leaders attended.

Policy briefing

One hundred congressional staff members attended a briefing February 2, 1985, on food and agricultural policy sponsored by the national center, the Congressional Research Service, and the Farm Foundation. Among the briefers was national center resident fellow Katherine Clancy, who spoke on the domestic food assistance program. The gathering was held just out of the Washington, D.C., metropolitan area, in Hagerstown, Maryland.

United States versus Europe

The national center cosponsored a conference with the Curry Foundation, "Confrontation or Negotiation: United States Policy and European Agriculture," on June 17 and 18 in Washington, D.C. Topics included U.S. responses to perceived inequities of the European Community's Common Agricultural Policy.

PUBLICATIONS

The best research in the world is useless if it remains solely with its parent: in effect, uncommunicated results do not exist. Thus, RFF has always worked to communicate the findings of its research staff to those who could employ and apply them in the classroom, the boardroom, and the halls of government.

Books and studies

For RFF, the principal means of disseminating its research findings has been the printed page. For results of significant substance and length, this means books, studies, and research papers, more than 160 of which now are in print.

Major studies generally are published as clothbound books if they will make an important contribution to the field or to public understanding and are likely to have broad appeal, either at the time of publication or over the course of a few years. When they appear to have especially broad appeal, such as for course use, books also may be published in a paperback edition.

During the 1985 program year, RFF instituted a new type of publication called a study. This category is designed for work that is narrower in scope and briefer in presentation than what is appropriate for books, but which is, nevertheless, of high quality.

With rare exceptions, both books and studies are published by Resources for the Future and distributed for RFF by the Johns Hopkins University Press. As a matter of policy, RFF does not publish work unrelated to its research program.

Other publications

Length, subject matter, stage of research, and intended readership may argue for a format different than a book or study.

- Staff scholars contribute regularly to professional journals. The RFF reprint series offers free, single-copy distribution of a selected number of these articles on request; thousands of copies are provided each year.

- Researchers frequently need to solicit comments from professional colleagues while work is in progress. They also may wish to release early results in a more timely fashion than is possible with formal

publication. The discussion paper series is designed to meet both needs.

- RFF publishes a quarterly periodical, *Resources*, featuring timely articles on work in progress and analyses of national and world developments. The annual "Highlights" issue, published in February, examines a wide range of the most noteworthy developments affecting resources and the environment during the preceding year. Subscriptions to *Resources* are free and may be obtained by writing the Office of Publications and Communication.

Six books and one study were published in the year beginning October 1, 1984, and each is described in the following section. Bibliographic information on all of the books, research papers, reprints, and discussion papers published during the program year is listed at the end of this section.

THE ECONOMICS OF NATURAL ENVIRONMENTS: STUDIES IN THE VALUATION OF COMMODITY AND AMENITY RESOURCES

Economic evaluation of parks and wilderness areas, known as amenity resources, long was neglected by traditional cost-benefit analysis. The result was that land managers, faced with allocation decisions involving incompatible uses, often opted for the tangible benefits of extractive development, taking little account of the economic losses incurred in the destruction of an irreplaceable natural area.

In this pioneering study, first published by RFF in 1975 and now brought up to date by the authors, John V. Krutilla and Anthony C. Fisher put the amenity resources of natural environments into an analytical framework comparable to that for the extractive resources. The models and theoretical background of their techniques are illustrated by case studies, three of which were so controversial and drawn-out that they have achieved near-celebrity status—the Hells Canyon dam, the Mineral King ski resort, and the Trans-Alaska pipeline.

The authors point out that resource development activities undertaken

on public lands often receive financial advantages—preferential tax treatment, subsidized capital, and access to public resources—that are not taken into account in the costs of the project. True evaluation of the costs and benefits of a development project often tips the balance in favor of preserving an area in a natural state.

Krutilla is senior fellow in RFF's Renewable Resources Division. Fisher is a professor of energy and resources and of economics and agricultural and resource economics at the University of California, Berkeley.

EMISSIONS TRADING: AN EXERCISE IN REFORMING POLLUTION POLICY

Hailed by Senator Pete Domenici as "the one bright idea that has emerged during the 1980s," the emission trading program represents the first large-scale attempt to use economic incentives in environmental policy in the United States. An attempt to inject some flexibility into the implementation of the Clean Air Act, it allows plants to accumulate credits for reducing emissions beyond the levels dictated by EPA and to sell or trade those credits to other plants whose pollution control costs are higher.

In this first book-length review of the program and the ways in which it has evolved, Thomas H. Tietenberg weaves together a vast amount of theoretical and empirical information with a detailed analysis of the implementing regulations and transactions under the program.

The basic questions are: Did the emissions trading program improve on the policies of the 1970 Clean Air Act? How closely has it fulfilled its objectives of enhancing cost effectiveness and encouraging the speed of compliance? What further reforms are possible?

Measured against the first benchmark, there can be little doubt that the program has improved upon the policy that preceded it. Total estimated savings of the "bubble" over the command-and-control approach were more than $700 million, with $10 million being saved every year in reduced operating costs, even while emission loadings are being reduced.

Other aspects of the program, however, have been less successful. The cost savings actually achieved, for instance, are considerably less than might reasonably have been expected.

Nevertheless, emissions trading has endured and promises to remain

an integral part of U.S. air pollution control policy. This study makes a number of recommendations for improvement. They include changing the standard for measuring progress in nonattainment areas, removing the prohibition against periodic controls, drastically improving the air quality accounting system, and facilitating multiplant trades with distant sources.

Tietenberg is associate professor of economics at Colby College, Waterville, Maine.

ENERGY, FORESIGHT, AND STRATEGY

Thomas Sargent and his collaborators have produced a rigorous treatment of "rational expectations" theory and its application to the study of energy markets. Their essays use dynamic games to study a variety of issues important to analysts and decision makers in the energy field. For example, they address the economic interests that oil-exporting countries have in embargoing supplies and the design of optimal oil tariffs by an importing country when market conditions are changeable but uncertain. Focusing on the United States, their analysis reveals how past regulation has masked the potential responsiveness of U.S. oil supply to price changes, showing that this responsiveness can be estimated by using available data. Methods for analyzing oil supply in noncompetitive markets and empirical estimates of oil exploration behavior in the United States are also included.

Rational expectations theory and methods assume that economic actors plan ahead efficiently both in making current decisions (production, consumption, and investment) and in using current information to forecast future economic conditions and institutional constraints. These essays construct linear rational expectation models of various aspects of energy extraction and consumption and deal with dynamic and strategic aspects of energy markets in the presence of uncertainty. The authors derive and apply new results on linear-quadratic dynamic games and construct several examples in which a rational expectations equilibrium fails to be socially optimal. For these examples, they describe government policies to correct the suboptimalities. In one case, the optimal government intervention turns out to be a dynamic tariff policy.

This collection of essays offers energy analysts and scholars a new perspective on familiar problems.

Sargent is professor of economics at the University of Minnesota, Minneapolis.

EXTERNAL COSTS OF COASTAL BEACH POLLUTION: AN HEDONIC APPROACH

Estimates of economic damages from oil spills and other incidents are required if the United States is to manage its coastal zones efficiently. The results of this book, by Elizabeth A. Wilman, make possible for the first time a rational judgment regarding whether the benefits of developing offshore oil outweigh the costs.

The study develops and describes a methodology for imputing a monetary value to the loss in beach recreational services that would result from a hypothetical oil spill in the Georges Bank area off Massachusetts. It combines an oil-spill risk analysis model with an hedonic pricing model of the market for tourist accommodations on Cape Cod and Martha's Vineyard to generate estimates of beach pollution costs associated with offshore oil development. Wilman's methodological approach also can be used to value other nonmarket resource services.

Wilman, formerly a member of RFF's Quality of the Environment staff, is adjunct associate professor in the Department of Economics at the University of Calgary.

MEASURING THE BENEFITS OF CLEAN AIR AND WATER

Is it possible to measure the benefits and costs of clean air and water? For the past few years, Allen V. Kneese and his colleagues have been applying the principles of cost-benefit analysis to questions of environmental quality. In this volume Kneese discusses their methods for quantitatively estimating the benefits derived from the maintenance or improvement of air and water quality.

The studies have centered on two broad approaches. The first involves

methods based, however indirectly, on observed human behavior with respect to environmental goods, including travel to recreational opportunities of varying quality and prices paid for houses in different locations. The second approach involves questioning respondents about their willingness to pay for various hypothetical changes in environmental quality.

This short, readable book examines the current state of the art regarding benefits assessment, including such tools as bidding games, surveys, property-value studies, wage differentials, risk reduction evaluation, and mortality and morbidity cost estimation.

Kneese is senior fellow in RFF's Quality of the Environment Division.

THE NONPROLIFERATION ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY: A CRITICAL ASSESSMENT

An organization unknown to most Americans helps guard U.S. security and preserve global peace: the International Atomic Energy Agency (IAEA), established in 1957, plays a unique role in halting the spread of nuclear weapons. In effect ceding a slice of sovereignty, most of the nations of the world—having pledged not to acquire or use nuclear weapons—have agreed to IAEA inspection to verify they are keeping their pledge.

But how effective are these safeguards? Pakistan, Israel, Taiwan, South Africa, and other countries in and out of geopolitical hot spots are widely believed to have achieved nuclear weapons capability, or close to it. And the IAEA itself is plagued by growing politicization, so much so that the United States walked out of the organization in 1982 only to walk back in again in 1983. Has the agency become largely irrelevant?

In this critical assessment, Lawrence Scheinman examines the history, structure, operations, and mounting problems of the IAEA and concludes that, while flawed and beset by impossibly high expectations, it is indispensable. He calls for strong U.S. leadership to reinvigorate the agency so that its nonproliferation mission has the full confidence of the international community.

This is the first in a new occasional series of RFF studies. Scheinman is professor of government at Cornell University.

THE RICE ECONOMY OF ASIA

Rice is the center of existence for well over a billion people. Nowhere is this more true than in Asia, where more than 90 percent of the world's rice is grown.

The Rice Economy of Asia covers the changes that have occurred in the Asian rice economy since World War II, and in particular since the introduction of modern varieties and technology in the mid-1960s. It describes a wide range of issues relating to rice production, marketing, trade, and policy, and develops several of the controversial issues surrounding modern rice technology, including who has and who has not benefited from its introduction.

Although a vast amount of literature and statistical data has been published on various aspects of the subject, no single comprehensive treatment previously has been prepared. This book fills that gap and also presents a clear picture of some of the critical issues dealing with productivity and equity.

In addition to 18 chapters, there are an extensive bibliography, 150 tables, and 50 charts. The volume should be interesting and useful to decision makers at national and international levels, to professionals, and to students of development.

Authors Randolph Barker and Robert W. Herdt, both formerly agricultural economists at the International Rice Research Institute, are, respectively, professor of agricultural economics at Cornell University and scientific advisor to the Consultative Group on International Agricultural Research. Beth Rose, who assisted them, is an Asian scholar at Cornell.

BOOKS

RFF books and research papers published during the 1985 program year (October 1, 1984–September 30, 1985):

Barker, Randolph, Robert W. Herdt, with Beth Rose. *The Rice Economy of Asia*. RFF, 1985. 348 pp. Cloth, $30.00. 0–915707–14–4. Paper, $12.00. 0–915707–15–2.

Kneese, Allen V. *Measuring the Benefits of Clean Air and Water*. RFF, 1984. 174 pp. $5.95. 0–915707–09–8.

Krutilla, John V., and Anthony C. Fisher. *The Economics of Natural Environments: Studies in the Valuation of Commodity and Amenity Resources*. Second edition. RFF, 1985. 322 pp. $10.50. 0–9157907–19–5.

Sargent, Thomas J., editor. *Energy, Foresight, and Strategy*. RFF, 1985. 220 pp. $18.00. 0–915707–10–1.

Scheinman, Lawrence. *The Nonproliferation Role of the International Atomic Energy Agency: A Critical Assessment*. RFF study, 1985. 80 pp. $8.95. 0–915707–18–7.

Tietenberg, T. H. *Emissions Trading: An Exercise in Reforming Pollution Policy*. RFF, 1985. 238 pp. $22.50. 0–915707–12–8.

Wilman, Elizabeth A. *External Costs of Coastal Beach Pollution: An Hedonic Approach*. RFF, 1984. 208 pp. $15.00. 0–915707–08–X.

REPRINTS

214. *Forest Management for Increased Timber and Water Yields*, by Michael D. Bowes, John V. Krutilla, and Paul B. Sherman. 1984.

215. *Property Rights in Orbit—Slicing the Geostationary Pie*, by Molly K. Macauley and Paul R. Portney. 1984.

216. *Competition for Water*, by Kenneth D. Frederick and Allen V. Kneese. 1984.

217. *Rural Land Use Policies and Rural Poverty*, by Frank J. Popper. 1984.

218. *Assessing U.S. Vulnerability to Raw Material Supply Disruption: An Application to Nonfuel Minerals*, by Michael Hazilla and Raymond J. Kopp. 1984.

219. *World Food Prospects to the Year 2000*, by Fred H. Sanderson. 1984.

220. *A Time for Every Purpose: The Case of Energy*, by Hans H. Landsberg. 1985.

DISCUSSION PAPERS

D–82AA. International Cooperation in Tariffs and Stockpiles for Coping with Oil Supply Disruptions. Frederic H. Murphy, Michael A. Toman, and Howard J. Weiss. November 1984.

D–82BB. A Dynamic Nash Game Model of Oil Market Disruptions and Strategic Stockpiling. Frederic H. Murphy, Michael A. Toman, and Howard J. Weiss. January 1985.

D–82CC. The Implications of Macroeconomic Disruption Costs and Public-Private Interactions for Strategic Oil Stockpiling. Frederic H. Murphy, Michael A. Toman, and Howard J. Weiss. January 1985.

D–82DD. Futures Trading and Oil Market Conditions. Douglas R. Bohi and Michael A. Toman. March 1985.

D–82EE. How Might IEA Crisis-Management Programs be Restructured to Better Serve Member Country Interests? Douglas R. Bohi and Michael A. Toman. March 1985.

D–125. The Nonproliferation Role of the International Atomic Energy Agency: A Critical Assessment. Lawrence Scheinman. February 1985.

QE84–01. Imperfect Monitoring of Sources of Externalities: Lessons from Single and Multiple Play Games. Clifford S. Russell. 1984.

QE84–02. Urban Air Quality and Acute Respiratory Illness. Paul R. Portney and John Mullahy. 1984.

QE84–03. Hurdle Models for Discrete and Grouped Dependent Variables. John Mullahy. 1984.

QE84–04. A Wald Test for the Cragg-Tobit Model. John Mullahy. 1984.

QE84–05. Implications of Environmental Policy for U.S. Agriculture: The Case of Ambient Ozone Standards. Raymond J. Kopp, William J. Vaughan, Michael Hazilla, and Richard Carson. 1984.

QE84–06. Capital Aggregation in Sectoral Producer Models. Michael Hazilla and Raymond J. Kopp. 1984.

QE84–07. Systematic Effects of Capital Service Price Definition on Perceptions of Input Substitution. Michael Hazilla and Raymond J. Kopp. 1984.

QE84–08. Intertemporal and Interspatial Estimates of Agricultural Productivity. Michael Hazilla and Raymond J. Kopp. 1984.

QE84–09. Valuing the Benefits of Health and Safety Regulation. Winston Harrington and Paul R. Portney. 1984.

QE84–10. Profit Maximizing Communities and the Theory of Local Public Expenditure: Reply. Jon C. Sonstelie and Paul R. Portney. 1984.

QE84–11. The Measurement of Sectoral Productivity: A Comparative Evaluation of Alternative Approaches. Michael Hazilla and Raymond J. Kopp. 1984.

QE84–12. Air Pollution and Lung Function in Children. Alan J. Krupnick and Winston Harrington. 1984.

QE85–01. Ethics and Environmental Economics. Allen V. Kneese. 1985.

QE85–02. Respirable Particulates and Acute Respiratory Disease in Children: An Analysis of CHESS Data from Birmingham, Alabama. Winston Harrington and Alan J. Krupnick. 1985.

QE85–03. Pitfalls in Applied Welfare Analysis with Recreation Participation Models. William J. Vaughan, Clifford S. Russell, and Julie Ann Hewitt. 1985.

QE85–04. Imposing Curvature Restrictions on Flexible Functional Forms. Michael Hazilla and Raymond J. Kopp. 1985.

QE85–05. WALRAS Documentation, vol. I. An Introduction to Numerical General Equilibrium Models Used for Applied Welfare Analysis. Michael Hazilla and Raymond J. Kopp. 1985.

QE85–06. Maternal Work Status and Childhood Illness: Evidence from CHESS. Winston Harrington and Alan J. Krupnick. 1985.

QE85–07. Bearing the Cost of Industrial Disease: The Asbestos Case. Donald N. Dewees. 1985. (Renamed: Economic Incentives for Controlling Industrial Disease: The Asbestos Case.)

QE85–08. The Public's Willingness to Pay for Boatable, Fishable and Swimmable Quality Water. Richard Carson and Robert Cameron Mitchell, 1985.

QE85–09. Cigarette Smoking, Air Pollution, and Respiratory Illness: An Analysis of Relative Risks. John Mullahy and Paul R. Portney, 1985.

QE85–10. Efficiency Properties of Alternative Source Control Policies for Meeting Ambient Air Quality Standards: An Empirical Application to the Lower Delaware Valley. Walter O. Spofford, Jr., 1985.

QE85–11. A Note on Testing and Correcting for Starting Point Bias in Contingent Valuation Surveys. Richard T. Carson, Gary L. Casterline, and Robert Cameron Mitchell, 1985.

QE85–12. From Conservation to Environmental Movement: The Development of the Modern Environmental Lobbies. Robert Cameron Mitchell, 1985.

QE85–13. Testing for Separable Functional Structure in the Presence of Disequilibrium. Michael Hazilla and Raymond J. Kopp, 1985.

RR85–01. An Econometric Data Base for the U.S. Agricultural Sector. Susan M. Capalbo, Trang T. Vo, and James C. Wade, 1985.

RR85–02. Testing Long-Run Productivity Models for the Canadian and U.S. Agricultural Sectors. Susan M. Capalbo and Michael G. S. Denny, 1985.

RR85–03. A Survey of Econometric Evidence on Productivity and the Structure of Agriculture. Susan M. Capalbo and Trang T. Vo, 1985.

RR85–04. Shelter in America: Costs, Supply Constraints, and the Role of Forests. Marion Clawson, 1985.

RR85–05. A Comparison of Econometric Models of U.S. Agricultural Productivity and Technology Structure. Susan M. Capalbo, 1985.

EM85–01. The Site Value of Locations in the Geostationary Arc. Molly K. Macauley.

EM85–02. The Welfare Cost of Regulatory Policy Governing the Geostationary Arc. Molly K. Macauley.

EM85–03. Implementing an Auction: Steps Toward Improved Allocation of the Geostationary Arc. Molly K. Macauley.

Gilbert F. White Fellowship

Bryan Norton and Michael Watts are Gilbert F. White fellows for the 1985–1986 academic year. The fellowships were established in 1980 in honor of Dr. White, distinguished geographer and former chairman of RFF's board of directors.

The fellowships, awarded annually, are intended for young professionals who wish to devote a year to scholarly work at RFF on social or policy problems in the area of natural resources, energy, or the environment.

Norton, an associate professor of philosophy at the New College of the University of South Florida, is devoting his year at RFF to exploring the values sought by environmentalists, with particular emphasis on the differences between conservationists and preservationists.

Watts, assistant professor of geography at the University of California, Berkeley, is expanding on earlier work in which he has examined oil-based commodity booms and their influences upon agrarian policy.

Natural Science Fellowship

In 1981 the Andrew W. Mellon Foundation made possible the establishment of an RFF resident fellowship in the natural sciences. Its purpose is to inform and broaden RFF's traditional strengths in the social sciences by bringing to the staff persons skilled in the approaches and insights of the natural sciences.

The Natural Science Fellow for 1985–1986 is Philip H. Abelson, a geophysicist and organic geochemist as well as retired editor of *Science* magazine. Abelson is pursuing research on the scope of the hazardous waste problem facing society; he also provides scientific and technical support to other staff members.

The Albright Fellowship

Early in 1982 RFF established the Horace Marden Albright Fellowship in Public Lands Studies in honor of Horace Albright, a founder of RFF in 1952, its first president, and former chairman of its board of directors. The first recipient of the fellowship was Michael D. Bowes, a fellow in the Renewable Resources Division. The fellowship, awarded periodically to a professional who wishes to devote time in residence at RFF to scholarly work on social or policy problems involving the public lands, draws its principal support from a grant from Laurance S. Rockefeller.

RFF Small Grants Program

The Small Grants Program is intended to address a need that is not now being met by most funding agencies, which tend to emphasize large projects and require complex lengthy applications.

The recipients of the 1985 grants, their affiliations, and topics are:

- Douglas L. Anandalingam, University of Virginia, "Production Efficiency, Rationing and Measurement Error in Industrial Factor Demand Models for Developing Countries."
- Martin T. Katzman, University of Texas, Dallas, "The Acceptability of Chemical Risks in the Environment."
- Karen R. Polenske, Massachusetts Institute of Technology, "Canadian-U.S. International Fishing Boundary Dispute."
- Marc S. Robinson, University of California, Los Angeles, "The Effects of Alternative Tax and Leasing Policies for the Outer Continental Shelf."
- Alfred Runte, University of Washington, "Yosemite National Park and Its Resources: A Centennial History."

RFF's institution-wide fellowship and grants programs are administered by Vice President John F. Ahearne.

NCFAP dissertation fellowships

The National Center for Food and Agricultural Policy offers support for the completion of dissertations by doctoral candidates researching food, agricultural, and resource-use policy.

Students receiving fellowships for the 1985–1986 academic year are Carolyn Harper of the University of California, Berkeley, Department of Agricultural and Resource Economics, for her research on "Optimal Regulation of Agricultural Pesticides"; and Robert Myers of the University of Minnesota, Department of Agricultural and Applied Economics, for his research on "Economic Efficiency When Markets Are Incomplete: The Case of U.S. Grain."

NCFAP resident fellowships

Four resident fellows joined the staff of the National Center for Food and Agricultural Policy for the 1985–1986 academic year. John M. Antle, associate professor of agricultural economics at the University of California, Davis, is studying the effects of environmental regulation on productivity. Christopher K. Leman, a former guest scholar at RFF, is assessing the use of experts and technical information in policy debates on four current issues—the dairy program, food stamps, soil conservation, and European food trade relations. Judith S. McGuire, nutrition policy advisor to the U.S. Agency for International Development, is examining the effects on world hunger of nutrition programs, agricultural development, and investments in human resources. Richard W. Wahl, an economic analyst at the Department of the Interior, is focusing on the history of federal water subsidies for agriculture and the potential for voluntary market transfer of water to promote its more efficient use in the West.

NCFAP Small Grants Program

In 1984 the National Center for Food and Agricultural Policy established a Small Grants Program, awarding one-year grants to selected institutions to encourage promising policy analysis or education projects related to food, agriculture, and natural resources. The 1985–1986 recipients and their projects are:

- At the University of Maryland, Bruce L. Gardner, of the Department of Agricultural and Resource Economics, and James A. Roumasset, a visiting professor from the University of Hawaii, Manoa, head a project on the "Political Economy of Rice Policy in Asia and the United States."

- "An Examination of the Macroeconomic Effects on the Appropriate Design of Agricultural Policies" is being conducted at the University of California, Berkeley, by H. Alan Love, a Ph.D. candidate, and Gordon C. Rausser, of the Department of Agricultural and Resource Economics.

- Also at Berkeley's Department of Agricultural and Resource Economics, Alain de Janvry and visiting scholar Elisabeth Sadoulet of the

University of Geneva are exploring "Styles of Economic Development, Strategies of Food Security, and U.S. Grain Exports."

- "U.S. Immigration Reform and Mexico–U.S. Migration Decisions: Implications for Agricultural Labor Markets in the United States" is being directed by J. Edward Taylor of the Urban Institute's (Washington, D.C.) Program in Demographic Studies.

- Ph.D. candidate Mary H. Vesenka of the University of Hawaii, Manoa, Department of Agricultural and Resource Economics, is seeking "An Explanation of Legislative Behavior Concerning Agricultural Policy."

- At the Harvard Institute for International Development, visiting scholar Charles K. Mann is working (with Malcolm McPherson) on a book manuscript entitled "Managing National Food Systems: A Capacity Development Approach," an outgrowth of Rockefeller Foundation programs to assist developing countries in designing more effective food policies.

- Robert Stavins of Harvard University's Department of Economics is pursuing research on "Conversion of American Wetlands to Agricultural Uses: An Economic Analysis of Alternative Renewable Resource Strategies."

- The Virginia Polytechnic Institute and State University's project, "Managing Environmental Risk: The Case of Agricultural Nonpoint Source Pollution of Groundwater," is being conducted by Sandra S. Batie and Randall A. Kramer, both of the Agricultural Economics Department.

- At the International Food Policy Research Institute, Washington, D.C., Michel Petit is analyzing "The Role of Pressure Groups and of Ideology in International Agricultural Trade Negotiations: Comparison of the Positions Taken in GATT by the United States and the European Community." Petit is a professor at the Ecole Nationale Supérieure des Sciences Agronomiques Appliquées, Dijon, France.

POLICY EDUCATION PROGRAM

Funded by both foundation and corporate support, the Policy Education Program provides increased financial resources, central planning, and institutional impetus to the dissemination of research results for use in the policy process. Activities for the 1985 program year include:

- Public service by the research staff including testimony to congressional committees, service on task forces, study groups, and commissions, and briefings of government staff on a host of issues: acid rain policy, natural gas deregulation, environmental monitoring and enforcement, soil conservation, outdoor recreation and land use, oil prices and import policy, energy and national security, food and agricultural policy, international forest products trade policy, ozone and human health effects, and giardiasis and safe drinking water.

- Policy briefings for business leaders:

  "International Trade and the Pacific Rim: Focus on Resources," held in Seattle, Washington, cosponsored by the Weyerhaeuser Company and Preston, Thorgrimson, Ellis & Holman.

  "Western Water and Energy Issues," held in Denver, Colorado, cosponsored by the United Banks of Colorado.

  "Emerging Energy and Environmental Issues: Government Regulation and Market Performance," held in New York City, cosponsored by the Exxon Corporation.

  "The Economics and Policy Issues of Outer Space Research," held in Washington, D.C.

- *Resources*, a quarterly publication with a circulation of more than 20,000.

- Three special meetings in Washington, D.C., on economics of mineral exploration, current agricultural issues, and U.S.–Japan forest products trade policy.

FOCUS, a Washington consortium for public affairs programming, com-

pleted ten years of radio broadcasting in 1985. Weekly programs are produced the year around and distributed via two channels. Some 160 mostly public stations throughout the country subscribe to the series through the Longhorn Radio Network of the University of Texas; each program also is offered via satellite to the 300 member stations of the National Public Radio network.

FOCUS shows feature staff members and guests of the sponsoring organizations in a half-hour interview-discussion format. Topics span the spectrum of interests represented by the members—the American Association for the Advancement of Science, the Conservation Foundation, the International Law Institute, the Overseas Development Council, the Johns Hopkins University School of Advanced International Studies, and Resources for the Future, which also serves as the consortium's administrative headquarters. All members are located in Washington, D.C., and are nonprofit and nonpartisan.

RFF programs recorded during the 1985 fiscal year include the following, in chronological order.

- The dangers and expense of overreacting to the threat of asbestos in buildings were emphasized by RFF Gilbert White Fellow Donald N. Dewees in an interview with independent broadcast journalist Karen Kalish.

- The politics and policies involved in the debate surrounding the 1985 farm bill were addressed by former secretaries of agriculture Bob Bergland, Earl Butz, and Clifford Hardin, and former undersecretary John Schnittker.

- What is giardiasis and what are the costs and benefits of preventing it? Fellows Winston Harrington and Alan Krupnick described the outbreak of this gastroenteric disease in Luzerne County, Pennsylvania, in response to questions put to them by program host Daniel Zwerdling, who covers environmental affairs for National Public Radio (see page 28).

- The workings and critical importance of the International Atomic Energy Agency were outlined by Cornell University's Lawrence Scheinman and Gerald F. Tape, former U.S. representative to the IAEA. NPR's Daniel Zwerdling hosted the program (see page 23).

- Should the United States have a nutrition policy? Questions on hunger in America, food stamps and other aid programs, and food safety and nutrition were put to National Center for Food and Agricultural Policy Resident Fellow Katherine Clancy by National Public Radio's political correspondent, Linda Wertheimer.

- Biotechnology's vast potential in science, medicine, and renewable resources was explored by RFF Natural Science Fellow Philip H. Abelson, former editor of *Science* magazine. Henry L. Trewhitt, deputy managing editor of *U.S. News & World Report*, served as host.

- The Chinese economy and specifically the role of the energy sector were analyzed by senior fellow Joy Dunkerley and senior fellow emeritus Hans H. Landsberg, recent visitors to the People's Republic. They were interviewed by RFF's Kent A. Price, FOCUS consortium coordinator.

FOCUS programs are produced and directed for the consortium by Mike Waters.

OUTSIDE STAFF ACTIVITIES

John F. Ahearne • Associate member of the Defense Science Board; member of a Study on Nuclear Obscuration (nuclear winter); member of a Study on the *Journal of Defense Research*; chairman of the review group for the U.S. Air Force Innovation Task Force; member of U.S. General Accounting Office advisory panels on risk evaluation and to the Program Evaluation and Methodology Division; chairman of the board of directors of the Woodstock Theological Center at Georgetown University; keynote speaker at the Air Force Long-Range Planning Conference, Air University, Maxwell Air Force Base. • Spoke on nuclear power at the management group seminar of the Niagara Mohawk Power Company, Syracuse, New York. • Presented summary paper on policy implications at a National Academy of Sciences and National Academy of Engineering symposium on nuclear winter. • Presented a paper, "Lessons Learned and Not Learned," as a panel member at a National Academy of Engineering symposium on Hazards: Technology and Fairness. • Testified on the education and training of nuclear power plant personnel before the Subcommittee on Nuclear Regulation of the Senate Committee on Environment and Public Works, and on the Government in the Sunshine Act before the Subcommittee on Energy Conservation and Power of the House Committee on Energy and Commerce.

Jack Alterman • Participated in meetings of the Committee on Energy Statistics of the American Statistical Association with the administrator and staff of the Energy Information Administration (EIA), U.S. Department of Energy, to discuss and provide technical advice on specific aspects of the work of EIA.

Margaret S. Andrews • Served as a discussant on a panel, "Agricultural Policy and the Northeast," at a Conference on Northeast Agriculture organized by the Franklin Pierce Law Institute. • Presented a paper (with Katherine Clancy), "The Political Economy of the Food Stamp Program," at a workshop on the political economy of nutritional improvement jointly sponsored by the International Food Policy Research Institute and the United Nations University. • Served as a panel discussant at the Grant F. Walton Lecture in International Agriculture and Environmental Affairs.

John M. Antle • Presented a paper, "Technology and Uncertainty: Evidence from Egypt," at the Nineteenth International Conference of Agricultural Economists, Malaga, Spain.

Douglas R. Bohi • Presented a paper (with Joel Darmstadter), "The World Oil Market and New York Electricity," at a conference on New York's Electricity Future sponsored by the New York Power Authority and Cornell University.

Michael D. Bowes • Presented a paper, "Some Thoughts on Multiple Use Forest Planning," at the Society of American Foresters meetings in Ft. Collins, Colorado.

Harry G. Broadman • Served as a professorial lecturer in international economics at the Johns Hopkins University School of Advanced International Studies. • Presented papers: "Incentives and Constraints on Exploratory Drilling for Petroleum in Developing Countries: An Econometric Analysis," at the annual meeting of the American Economic Association, Dallas, Texas; "Regulatory Reform of Interstate Natural Gas Pipelines," in Cambridge, Massachusetts, and Houston, Texas; "Petroleum Firm Foreign Investment Strategies in Exploratory Drilling Outside North America," at the seventh annual meeting of the International Association of Energy Economists, Bonn, West Germany. • Conducted a seminar, "Econometric Determinants of Oil Exploration Activity Outside North America," at the U.S. Department of Energy.

Susan M. Capalbo • Served as a reviewer for the *American Journal of Agricultural Economics*, *Western Journal*

of Agricultural Economics, and the Sea Grant College Program. • Presented papers: "Testing Productivity Models for the Canadian and U.S. Agricultural Sectors," (with Michael Denny) at the 1984 American Economic Association meetings; "Agricultural Productivity: Issues Regarding Measurement and Explanation of the Important Factors Affecting Productivity Growth Rates," at the Society of Government Economists; "Productivity Measurement, Comparison of Parametric and Nonparametric Methods," at the University of California Agricultural Economics Workshop Series; (with Kenneth R. Farrell) "Natural Resource and Environmental Dimensions of Agricultural Development," and (with Trang T. Vo) "Comparing Agricultural Productivity: United States and Canada," at the 1985 International Association of Agricultural Economists meeting, Malaga, Spain.

Emery N. Castle • As a member of the Coal Policy Committee, attended the joint meeting of the National Coal Council, Washington, D.C. Presented paper, "World Hunger, U.S. Agriculture and Rural Resource Policy," at Brigham Young University. • Member, board of directors, Winrock International Institute for Agricultural Development. • Chaired discussion group, "Issues in World Agriculture," at American Agricultural Economics Association meeting, Ames, Iowa. • Served as panelist at the American Land Resource Association Forum, "Population Policy and the Land," Bethesda, Maryland.

Katherine L. Clancy • Presented papers: "How Is Biotechnology Shaping Our Future Food Supply and Its Nutrients," at the 1985 National Food Policy Conference presented jointly by the Food Marketing Institute, Public Voice, and the American Farm Bureau Federation; "Food Production and Protection: Why Nutritionists Should Be Concerned," Massachusetts Public Health Association; (with Margaret Andrews) "The Political Economy of the Food Stamp Program," at a workshop sponsored by the International Food Policy Research Institute and the United Nations University; "Living at the Top of the Pyramid: Does the Confusion of Abundance Lead to an Abundance of Confusion?" at the Thirteenth International Congress on Nutrition in Brighton, England. • Spoke on the National Center for Food and Agricultural Policy to the National Nutrition Consortium at its Nutrition Policy Seminar; and on domestic food assistance at the Agriculture and Food Policy Conference for congressional staff. • Participated on a panel, "Resource Education and the Future of the Land," at the American Land Resource Center.

Marion Clawson • Continued on editorial advisory boards of *Environmental Professional* and *Landscape Planning* and as Honorary Vice President, American Forestry Association. • Presented a paper, "Human Health and Water Quality as Related to Use and Management of Water for Recreation," at Rene Dubos Center for Human Environments, New York. • Participated in seminars or workshops as follows: Congressional Research Service, Federal Rangelands Workshop; annual meeting of Forest History Society (elected Fellow); National Research Council, Convocation on Physical Dimensions of Erosion Problem; General Accounting Office, Natural Resources Management Planning Conference; and U.S. Department of Agriculture, planning conference on National Range Conference—Opportunities for the Future (represented both RFF and American Agricultural Economics Association).

Pierre R. Crosson • Presented papers: on conservation tillage at a conference sponsored by the U.S. Department of Agriculture; "National Costs of Erosion Effects on Productivity" at the annual meeting of the American Society of Agricultural Engineers; "Agricultural Land: A Question of Values" at a colloquium at the University of Tennessee on social, economic, and environmental issues in management of agricultural land. • Gave a seminar at the University of Rhode Island on soil erosion and soil

conservation policy. • Participated in a USDA workshop on erosion-productivity relationships; participated in a symposium, chaired a session, and discussed a paper at the annual meeting of the American Agricultural Economics Association. • Gave talks: "Toward More Efficient and Equitable Environmental Policies: the Role of Economists" at an international meeting on the environment in economic development, Monterrey, Mexico; on resource and environmental issues in Guadalajara and Mexico City, sponsored by the U.S. Information Agency. • Member, Research, Teaching and Extension Users Advisory Board, USDA; secretary, Association of Environmental and Resource Economists.

Joel Darmstadter • Presented a paper (with Douglas R. Bohi), "The World Oil Market and New York Electricity," at a conference on New York's Electricity Future, sponsored by the New York Power Authority and Cornell University. • Was the keynote speaker at a conference, "Managing Utilities in a Changing Environment," sponsored by Public Utilities Reports, Inc. • Wrote a guest editorial in *Energy and Education* published by the National Science Teachers Association and a book review in *Environment* magazine. • Served as contributing editor to *Environment* magazine, as a member of the editorial committee of the *Annual Review of Energy*, and as a professorial lecturer at the Johns Hopkins University School of Advanced International Studies.

Joy Dunkerley • Served as discussant in an international symposium organized by the Swedish National Energy Administration held in Stockholm. • Member of the Atlantic Council of the United States/World Energy Conference working group, "Energy Supply and Use in Developing Countries." • Chaired session, "Electricity and Coal Markets," at the conference on North American Energy Markets, Toronto, Canada, organized by the Canadian Energy Research Institute. • Delivered lectures: "Energy in the Developing World" at the University of Kashmir in Srinagar; "Energy and Economic Development" at a conference on Women in International Development. • Organized session for seventh annual conference of the International Association of Energy Economists, Bonn, West Germany. • Led delegation of energy economists to the People's Republic of China. • Gave lectures on: commercial fuelwood markets in developing countries and policy and energy in China at Oak Ridge National Laboratory; transport and energy at a seminar on energy policy research organized for U.S. Agency for International Development (AID) Office of Energy; the role of conservation in energy policy at Ravishankar University, Raipur, India. • Served as: council member of the International Association of Energy Economists; member of the editorial boards of the *Energy Journal*, *Energy Policy*, and Cambridge Energy Studies series; member AID Energy Policy Development and Conservation Project Advisory Committee.

Roderick G. Eggert • Presented papers: "Recent Trends in Mineral Exploration," at Dartmouth College; "A Simple Economic Model of Metals Exploration Expenditures: The United States, Canada, and North American Firms," at the Sixteenth Annual Modeling and Simulation Conference in Pittsburgh, Pennsylvania. • Served on the organizing committee for the 1985 Mineral Economics Symposium, sponsored by the mineral economics subsection of the Washington, D.C., chapter of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), and attended the AIME annual meeting in New York City.

Kenneth R. Farrell • Served as a member of a presidential task force to Zaire; chairman of the Seventy-Fifth Anniversary Committee and Fellow Elections Committee of the American Agricultural Economics Association; member of the Food and Agriculture Committee of the National Planning Association; member of the U.S. Department of Agriculture Graduate School Advisory Committee in Social Behavioral Sciences; reviewer for the

American Journal of Agricultural Economics. • Testified before the Senate Committee on Agriculture, Nutrition, and Forestry on the structure of U.S. agriculture. • Presented papers: "The 1985 Farm Bill: Approaches, Positions, and Strategies," at the University of Wisconsin Farm Policy Seminar; "Feeding a World of Six Billion People: Minimizing Resource Costs," at a seminar for journalists sponsored by Earthscan and the Medill School of Journalism; "U.S. Agricultural Policy and Trade: The 1985 Farm Bill, Longer Term Policies and Trade Implications," at the University of Saskatchewan's Conference on World Agricultural Policies and Trade; "U.S. Agricultural Policy Developments and Prospects," at the Fiftieth Anniversary Canadian Agricultural Outlook Conference; "Economic and Political Realities of the 1985 Farm Bill," at the Tenth Annual Mid-Winter Break of the Bank of North Dakota; "World Food Security and Insecurity, 1984–2000," at the Twenty-Sixth Annual Convention of the International Studies Association; "Economic and Financial Conditions in Agriculture," at the New American Realities meeting held by the National Planning Association; "Economic Prospects for U.S. Agriculture," at the annual meeting of Farm Credit Banks of St. Louis; "The Changing Nature of Food and Agricultural Policy and the Preparedness of Agricultural Economists to Contribute to Policy Formation," sponsored by the Virginia Polytechnic Institute and State University's Department of Agricultural Economics; "Future Food and Agricultural Policies," at the National Farm-City Conference; "Toward the 21st Century: Global Food Prospects," at the York University symposium on Prospects for Mankind; (with Susan M. Capalbo) "Natural Resource and Environmental Dimensions of Agricultural Development," at the International Association of Agricultural Economists meeting in Malaga, Spain. • Chaired a panel discussion, "Soil Erosion and the Future of American Agriculture," at the Resources, Environment and the 1985 Farm Bill Conference sponsored by the Roosevelt Center for American Policy Studies. • Participated in the Trilateral Commission meetings on Agricultural Policy and Trade: Adjusting Domestic Programs in an International Framework. • Reviewed, at the request of the U.S. Catholic Bishops, the draft chapter "Natural Resources, Food and Agriculture" of the Economic Pastoral Letter.

Kenneth D. Frederick • Participated in White House luncheon meeting with President Ronald Reagan, Vice President George Bush, and senior White House officials to discuss emerging issues and trends of national and international importance. • Participated in a workshop on Climate Impacts Research at the National Center for Atmospheric Research, Boulder, Colorado.

Leonard P. Gianessi • Presented a paper, "The Resources for the Future National Data Base for Nonpoint Source Policy Assessments," at a conference, Perspectives on Nonpoint Source Pollution, Kansas City, Missouri.

Winston Harrington • Presented a paper, "Short-term Nitrogen Dioxide Exposure and Acute Respiratory Disease in Children," and was a discussant at the Allied Social Science Association Meetings, Dallas, Texas. • Participated in a workshop, "The Public Interest in Private Forests," sponsored by the Forestry Research Institute and the U.S. Forest Service, St. Mary's College, St. Mary's City, Maryland.

Michael Hazilla • Presented papers (with Raymond J. Kopp): "The Measurement of Sectoral Productivity: A Comparative Evaluation of Alternative Approaches," at a conference, "Interindustry Differences in Productivity Growth," sponsored by the American Enterprise Institute, and, "Testing for Separable Functional Structure in the Presence of Disequilibrium," at the Fifth World Congress of the Econometric Society in Cambridge, Massachusetts.

Allen V. Kneese • Served as a member of the Working Group on Energy in Developing Countries, Atlantic Coun-

cil of the United States, and as a member of the Groundwater Protection Working Group, Environmental and Energy Study Institute. • Summarized a conference on Indian Water in the American West, sponsored by the American Indian Lawyer Training Program, Scottsdale, Arizona. • Served as a member of the Committee on Water Research, National Academy of Sciences, and as a member of the Panel on Monitoring Water Quality, National Academy of Sciences. • Consulted with staff of the Department of the Interior on the Navajo Indian Irrigation Project. • Presented a paper, "Water Transfers," at a meeting of the Food and Agricultural Committee of the National Planning Association, Denver. • Presented a seminar, "Water Markets," for the Department of the Interior staff. • Summarized a national conference, "Acid Rain: Economic Assessment," sponsored by Acid Rain Information Clearinghouse, Washington, D.C. • Participated in meetings of a special panel to consider the future of America's mineral industries, convened by the Bureau of Mines. • Discussed water scarcity on National Public Radio's "All Things Considered."

Raymond J. Kopp • Presented papers (with Michael Hazilla): "The Measurement of Sectoral Productivity: A Comparative Evaluation of Alternative Approaches," at a conference, "Interindustry Differences in Productivity Growth," sponsored by the American Enterprise Institute, and, "Testing for Separable Functional Structure in the Presence of Disequilibrium," at the Fifth World Congress of the Econometric Society in Cambridge, Massachusetts. • Presented a paper, "Intertemporal and Interspatial Estimates of Agricultural Productivity," at the University of Chicago.

Alan J. Krupnick • Presented papers: "The Chesapeake Bay: A Modeling Approach," at the Eighth Biennial Estuarine Research Federation Conference, Durham, New Hampshire; "Lung Function as a Risk Factor for Acute Respiratory Disease: An Epidemiological Analysis," at the Air Pollution Control Federal Conference, Detroit, Michigan; (with Winston Harrington) "Short-term Nitrogen Dioxide Exposure and Acute Respiratory Disease in Children," at the annual meeting of the American Economic Association, Dallas, Texas. • Presented a seminar (with Walter O. Spofford, Jr.) at the U.S. Environmental Protection Agency on "The Benefits of Avoiding an Outbreak of Giardiasis: A Case Study of the 1983–1984 Outbreak in Luzerne County, Pennsylvania." • Discussed the economic damages from outbreaks of giardiasis on National Public Radio's "All Things Considered" and on the Diane Rehm Show, WAMU-FM, Washington, D.C.; presented a seminar on the economic damages from outbreaks of giardiasis at the University of Maryland.

John V. Krutilla • Participated in the visiting scholar program at the University of Oklahoma and in a workshop on genetic preservation at the University of Washington. • Served on advisory committee of the Resources and Economic Policy Program of the Wilderness Society and as a consultant to the Forest Service. • Testified before the House Agriculture Committee's Subcommittee on Forests, Family Farms and Energy. • Served as a consultant to the United Nations in connection with water resources in Mendoza, Argentina.

Hans H. Landsberg • Served as a member of the Board on Mineral and Energy Resources of the National Academy of Sciences, of the Advisory Committee to the Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, of the Visiting Committee to the Applied Sciences Division of the Brookhaven National Laboratory, of the Committee on Population, Environment and Resources of the American Association for the Advancement of Science, of the Committee on Energy Conservation and of the Electric Energy Systems Committee of the Commission on Engineering and Technical Systems of the National Research Council, of the Advisory Panel on Materials Import Vulnerability of

the Office of Technology Assessment. • Continued to serve as a member of the editorial boards of *Daedalus*, *Resources Policy*, *Journal of Resource Management and Technology*, *Energy Journal*, and *Energia*. • Lectured on current energy issues at an executive seminar at the Brookings Institution and at the Foreign Service Institute. • Participated as a panel member in a conference on synfuels issues, arranged by the Congressional Research Service and the House Banking and Currency Committee. • Visited China as a member of a delegation of the International Association of Energy Economists. • Served as a consultant to the Montedison Corporation (Italy).

Christopher K. Leman • Served as a discussant on a panel, "Government as Consumer of Policy Analysis," annual meeting of Association of Public Policy Analysis and Management, New Orleans. • Presented a paper, "A Forest of Institutions: Patterns of Choice on North American Timberlands," to Seminar on Canadian-U.S. Relations, Center for International Affairs, Harvard University. • Prepared a paper (with Robert L. Paarlberg), "The Continued Political Power of Agricultural Interests," for the Conference on Agriculture and Rural Areas Approaching the 21st Century, annual meeting of the American Agricultural Economics Association, Ames, Iowa.

Molly K. Macauley • Served on the Space World Administrative Radio Conference Advisory Committee to the Federal Communications Commission. • Presented a lecture, "The Economics of Remote Sensing Satellites," at the U.S. Naval Academy; and "Economics and Outer Space: Pricing the Geostationary Orbit," to the Society of Government Economists.

Robert Cameron Mitchell • Lectured at the Foreign Service Institute of the U.S. Department of State. • Served as a panelist for a session, "Drinking Water Benefits," at the Annual Conference of the National Association of Water Companies. • Presented a seminar, "Benefits of National Water Pollution Control," at the University of Wisconsin-Madison. • Chaired a roundtable session on social movements at the annual meeting of the American Sociological Association.

John Mullahy • Presented papers: (with Paul R. Portney) "Cigarette Smoking, Air Pollution, and Respiratory Illness: An Analysis of Relative Risks," at the annual meeting of the American Economic Association, Dallas, Texas; "Habits and Demand: A Microeconomic Analysis of Cigarette Smoking," at the Labor and Population Workshop, Yale University Economic Growth Center.

Glenn L. Nelson • Led a discussion, "Land Grant Research Needs and Priorities," at the National Symposium on Local Infrastructure Investment Decisions. • Submitted a paper (with Thomas Stinson) as part of the report of the Minnesota Tax Study Commission to the governor of Minnesota. • Reviewed, at the request of the U.S. Catholic Bishops, the draft chapter "Natural Resources, Food, and Agriculture" of the Economic Pastoral Letter.

Henry M. Peskin • Attended the Conference on the Longitudinal Establishment Data File, Alexandria, Virginia. • Participated in the International Workshop on Environmental Accounting sponsored by the World Bank and the United Nations Environment Program in Washington, D.C., participated in the National Retreat on the Nonpoint Source Assessment Project of the Association of State and Interstate Water Pollution Control Administrators at Wye Plantation (Aspen Institute), Queenstown, Maryland. • Served as chairman of the session on Data Availability and Needs at the Conference on Perspectives on Nonpoint Source Pollution, Kansas City, Missouri, and served as member of the program committee. • Attended meetings of the American Agricultural Economics Association and served as member of the Symposium on Benefits of Agricultural Nonpoint Source Pollution Control. • Attended the Conference on Research in Income and Wealth

Symposium on Productivity in the U.S. and Japan, Cambridge, Massachusetts.

Tim T. Phipps • Prepared papers: "U.S. Agricultural Policy and Farmland Prices," for U.S. Department of Agriculture-Economic Research Service; "Agricultural Policy, Land Prices, and the Rate of Return on Investment in Agriculture," for the American Enterprise Institute; (with D. Pitt and B. Lessley) "The Maryland Agricultural Land Preservation Program: Diffusion of Innovation," for the Northeast Agricultural and Resource Economics Association annual meetings. • Served as reviewer for the *American Journal of Agricultural Economics*, the *Journal of Environmental Economics and Management*, and the National Sea Grant College Program.

Paul R. Portney • Served on Committee on Epidemiology of Air Pollutants, National Academy of Sciences, and on Outside Research Advisory Board for Interdisciplinary Programs in Health, Harvard University School of Public Health. • Was adjunct professor of the Washington Campus, a consortium of graduate schools of business. • Gave a talk, "Economic Efficiency and Acid Rain," at the national conference "Acid Rain: Economic Assessment" in Washington, D.C. • Presented a paper (with John Mullahy), "Cigarette Smoking, Air Pollution, and Respiratory Illness: An Analysis of Relative Risks," at the annual meeting of the American Economic Association, Dallas, Texas. • Delivered speech at a National Wildlife Federation meeting, "Tax Reform and the Environment."

Gordon C. Rausser • Presented papers: "Macroeconomic Policy in U.S. Agriculture," "Recent Developments in Macroeconomic Theory," "Current State of Agricultural Economics," and (with Kostas Stamoulis and James Chalfant) "Monetary Policies and the Overshooting of Flexible Prices: Implications for Agricultural Policy," at American Agricultural Economics Association Forty-Fifth Anniversary Meetings; "Instability in Agricultural Markets: the U.S. Experience," at the International Association of Agricultural Economists annual meetings; "Expectations and Intertemporal Pricing in Commodity Futures and Spot Markets," at the University of Chicago; "Lead Lag-Price Relationships Among Commodity Future Markets," at University of California, Los Angeles; "U.S. Agricultural Export Demand and Exchange Rates: Some Neglected Effects" at University of Illinois; "Local Versus Global Efficiency in Commodity Futures Markets" and "Economic Efficiency in Futures Markets: A General Equilibrium Approach" at London School of Economics; "Public Research in Agriculture: An Alternative Institutional Framework" at Harvard University; "Compensation Under Uncertainty: Ex Ante Versus Ex Post Rules" at the University of California, San Diego; "Agricultural Output and Effectiveness of Government Policy" at Iowa State University. • Served as editor of *American Journal of Agricultural Economics*; on board of American Agricultural Economics Association; director of Gianinni Foundation. • Selected for *Who's Who in America*.

Clifford S. Russell • Served as a member of the Environmental Studies Board of the National Research Council (NAS/NAE), as a member of the finance committee of the board of trustees of the Environmental Defense Fund, as chairman of the steering committee for the Eighth Symposium on Statistics, Law, and the Environment, held in Washington, D.C., and as a member of the Editorial Advisory Board, *Transnational Environmental Law Journal*. • Presented talks on the place of economic incentives in environmental policy to the Society of Government Economists and a conference organized by the Lincoln Land Institute, in Frankfort, Kentucky; on monitoring and enforcement at the Environmental Protection Agency, Vanderbilt University, and Woods Hole Oceanographic Institute; on damages to recreation from soil erosion pollution of waterways to a Conservation Foundation conference on Offsite Costs of Soil Erosion; and on planning for drought in municipal water systems at the American Water Works

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Associations annual meeting. • Gave a short course on monitoring and enforcement at the Vermont Law School in South Royalton, Vermont.

Fred H. Sanderson • Served as an advisor to the Curry Foundation, a member of the Trade Panel of the Atlantic Council of the United States, and a steering committee member of the Council on International Trade Policy. • Testified before the Foreign Agriculture Subcommittee of the House Committee on Agriculture on "Obstacles to U.S. Agricultural Exports: What Can We Do About Them?" • Spoke at the University of New Hampshire's Sidore Lecture Series on "Food as a Tool of Foreign Policy"; on "Food and Foreign Policy: Farming in an International Arena" at Washington State University's symposium, "The Family Farm: A Domestic and International Dilemma"; on a lecture tour in Germany and the Netherlands, sponsored by the U.S. Information Agency, discussed U.S. farm policy, U.S./European agricultural relations, and long-term economic prospects. • Met with the Young Farmers' Association in Baden; Ministry of Agriculture in Stuttgart; Institute for Agricultural Economics at the University of Goettingen; Ministry of Agriculture and Commodity Board Officials in The Hague; agribusiness and academic audiences in The Hague; and the International Trade Club in Rotterdam. • At the invitation of the French Ministry of Planning, led two seminars on "World Food Prospects to the Year 2000" at the Commissariat du Plan in Paris. • Spoke before the: staff of the Agriculture Directorate, Organisation for Economic Cooperation and Development, Paris, on U.S. agricultural policy; U.S. Information Agency seminar on "The Economics of Agricultural Trade"; Brookings Institution Executive Leadership Seminar on Critical Public Policy Issues on "World Food and Agricultural Prospects"; World Bank seminar on "World Food Prospects to the Year 2000"; Council on Foreign Relations seminar on "The Changing European Community—Implications for the United States: Agricultural Issues."

Roger A. Sedjo • Served as panelist at the Duke University meeting on "Foresight Capacity and Political Constraints: Global Linkages at the National Level." • Gave presentation on the long-term resource outlook to a meeting of security analysts sponsored by the Federal Paperboard Company. • Attended legislative tour sponsored by the Society of American Foresters on below-cost timber sales. • Participated in American Forestry Association Meeting on the Renewable Resources Extension Act. • Gave briefings on U.S.-Japan forest products trade at luncheon of industry representatives and at a meeting of legislative staff sponsored by the Senate Agriculture Committee. • Participated in an assessment of the progress of the World Resources Institute "Tropical Forest Action Plan"; attended seminar on global habitability entitled "Acid Precipitation and the Forest" at Columbia University. • Presented paper, "Commercial Forests, Environmental Values and Alternative Land Uses," at conference on Effective Use of Forest Resources in the Preservation of the Environment, Tokyo, Japan. • Participated at International Union of Forest Research Organizations Forest Sector Modelling meeting, Laxenburg, Austria. • Prepared papers: "The Global Timber Supply," as part of International Institute for Applied System Analysis's forest sector project; "Incentives and Tariff Barriers Related to Forest Products Trade," for Ninth World Forestry Congress, Mexico City; "Preliminary Results of a Six Region Optimal Control Model of Potential Timber Supply," at the International Institute for Applied Systems Analysis Forest Sector Project meeting, Varna, Bulgaria. • Presented lectures: "Tropical Forests," as part of the Society of American Foresters Science Day; to workshop on "Exporting Forest Products," Mobile, Alabama; "Outlook for the World and the U.S. Timber Supply," to Forest Products Research Society meeting on Timberland Investment Opportunities, Atlanta, Georgia. • Participated in a workshop on State and Private Forestry to assist the Forest Service in project criteria and methodology, St. Mary's City, Maryland. • Served as

member of U.S. Planning Committee and Section Moderator of Agricultural Development Council's Land Use Conference in Sapporo, Japan; member of advisory panel for the Agency for International Development's Forestry Private Enterprise Program; member of U.S. Steering Committee for the International Institute for Applied Systems Analysis Forest Sector Project; member, Society of American Foresters' Task Force on Federal Land Sales; member, Society of American Foresters' Task Force on International Forests; member, board of editors of the *Journal of Forestry*; member of the board of directors and executive committee of the Renewable Natural Resources Foundation; treasurer and member of the board of directors of the Association of Environmental and Resource Economists.

Walter O. Spofford, Jr. • Served as a member of the U.S. Committee on Scientific Hydrology (representing the American Geophysical Union), and of the board of directors of Roy F. Weston, Inc., Environmental Consultants-Designers, West Chester, Pennsylvania. • Presented a seminar (with Alan J. Krupnick) at the U.S. Environmental Protection Agency on "The Benefits of Avoiding an Outbreak of Giardiasis: A Case Study of the 1983–1984 Outbreak in Luzerne County, Pennsylvania." • Participated in the "Workshop on Environmental Accounting and Its Use in Development Planning" sponsored by the United Nations Environment Program and the World Bank, Washington, D.C., and in "Symposium on Hazards: Technology and Fairness" sponsored by the National Academy of Engineering, Washington, D.C. • Served as a member of the editorial board of the *Journal of Environmental Economics and Management*.

Michael A. Toman • Presented papers: "Economic Analysis of Nonrenewable Resource Supply: An Overview," at the annual meeting of the Southeast Natural Resource Economics Committee, Lexington, Kentucky; (with Douglas R. Bohi) "How Might IEA Crisis-Management Properties Be Restructured to Better Serve Member-Country Interests?" at Seventh Annual Meeting of the International Association of Energy Economists, Bonn, West Germany. • Served as a professorial lecturer at the Johns Hopkins University School of Advanced International Studies. • Served as a discussant on a panel, "Natural Resources: Theory and Practice," at the annual meetings of the Allied Social Science Associations, Dallas, Texas.

Trang T. Vo • Presented a paper (with Susan M. Capalbo), "Comparing Agricultural Productivity: United States and Canada," at the 1985 meetings of the International Association of Agricultural Economics, Malaga, Spain, and served as rapporteur on the technology session of the same conference.

John F. Ahearne
"Challenge for Energy Security Policy to the Year 2000 (Or Santayana Was Right)," in Richard J. Gonzalez, Raymond W. Smilor, and Joel Darmstadter, eds., *Improving U.S. Energy Security*, Ballinger, Cambridge, Massachusetts, 1985.

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STAFF CHANGES

Administration *James M. Banner, Jr.*, arrived on September 30 to head a new Office of Publications and Communication combining books, *Resources*, other publications, and editorial services; press relations and news media activities, including the FOCUS radio series; congressional and governmental relations; and public information and education. A widely published author and consultant, Banner was a member of the history faculty at Princeton University for fourteen years and was founder and chairman of the American Association for the Advancement of the Humanities. After more than a decade as an RFF editor, most recently as an important contributor to *Resources* and the Annual Report in addition to many book manuscripts, *Jo Hinkel* resigned her position to enter a graduate program in museum education. She was replaced by *Nancy A. Lammers*, who previously was senior editor in the book division of Congressional Quarterly.

Debra Montanino, formerly with the Brookings Institution, joined the Institutional Relations staff as associate for corporate relations. She replaces *Johannah E. Barry*, who left in midyear to become assistant director for membership and development of the Wilderness Society.

Louanne B. Sawyer (now *Saylors*) was married in January and moved to Albuquerque, New Mexico, where she accepted a position with BDM Corporation. She had provided—and for several years directed—computer services for RFF since 1973. *Charles M. Paulsen* was promoted to chief of Computer Services upon her departure.

Shelley R. Snyder, afternoon receptionist, left to attend graduate school and was replaced by *Sharynne M. George*, a student at the Johns Hopkins School of Advanced International Studies.

Energy and Materials Division Natural Science Fellow *Philip H. Abelson*, former editor of *Science*, is working on a project designed to reduce chemical wastes, particularly the chloroethanes-methanes. Consultant-in-residence *Jack Alterman* completed his work on the energy-GDP ratio and is now a private consultant. Research assistant *Caroline S. Boubdili* left at the end of the program year after completing her assignment. Fellow *Harry G. Broadman* is spending a one-year sabbatical teaching at Harvard University's John F. Kennedy School of Government. *Chester L. Cooper*, previously with the International Institute for Applied Systems Analysis in Laxenburg, Austria, is a new consultant-in-residence. Visiting Scholar *Roderick G. Eggert* has accepted an assistant professorship in the Department of Mineral Economics at Pennsylvania State University. *Mark J. Goldstein*, research assistant, resigned to accept a position with the Interstate Natural Gas Association of America. *Marshall F. Klaus*, who received his master's degree in agricultural economics from the University of California, Davis, joined the division as research assistant. *Regina Roberts*, formerly with the Health Industry Manufacturers Association, became secretary to Douglas R. Bohi and Michael A. Toman, filling the position previously held by *Nancy E. Waldo*, who left to enter the Information Systems Program at George Washington University. After five years as information specialist in the Energy and Materials Division and a brief period as acting administrative assistant in the Quality of the Environment Division, *Linda L. Walker* resigned to assume a position with the Program for the Introduction Adaptation of Contraceptive Technology. We note with sadness the death in December 1984 of *Harry Perry*, a consultant-in-residence since 1973. As in his long and distinguished government career, Perry shared with his RFF colleagues a deep understanding of fuel technology, research, and policy.

Quality of the Environment Division *Bryan G. Norton*, an associate professor of philosophy at the New College of the University of South Florida, is a Gilbert F. White Fellow for 1985–1986. Guest Scholar *Wallace E. Oates*, a professor of economics at the University of Maryland, is working with Paul R. Portney on an NSF-sponsored study, "National or Local Standards for Environmental

Quality?" *Winston Harrington* received his doctorate in city and regional planning from the University of North Carolina. *John Mullahy* was promoted to fellow after receiving his doctorate in economics from the University of Virginia. *Danny C. Lee*, on leave from doctoral studies at Texas A&M University, is working as a research assistant to Allen V. Kneese on a project to design models to assist the Bonneville Power Authority in fish and wildlife mitigation accounting policy. *Patricia A. Vasselo* resigned as secretary to Kneese, Harrington, and Alan J. Krupnick and was replaced by *Cheryl P. Johnson*, who previously had worked as a word processing specialist. After an association of nearly twenty years at RFF, *Blair T. Bower* left as consultant-in-residence to join the Conservation Foundation as a senior fellow consultant. *William J. Vaughan* resigned after fourteen years with RFF to accept a position as operations evaluation officer with the Inter-American Development Bank. *Donald N. Dewees*, a 1984–1985 Gilbert F. White Fellow, returned to the University of Toronto, where he is a professor of economics and law. Guest Scholar *Marc Laget* returned to France to begin French military service in the Ivory Coast. *Julie Ann Hewitt* resigned as research assistant to Clifford S. Russell to begin graduate studies in agricultural economics at the University of California, Berkeley. After completing work as a research assistant to Walter O. Spofford, Jr., Krupnick, and Harrington, *Tina Libenson* returned to Connecticut College and completed her studies for a bachelor's degree in economics. *Tracy Narel* resigned as research assistant to Krupnick to pursue further studies at Harvard University's John F. Kennedy School of Government. *Kathy Wagner-Johnson*, a doctoral student in political science at Cornell University, left her position as part-time research assistant to Robert Cameron Mitchell to continue research on her dissertation at the Office of Technology Assessment. *Sylvia A. Turner* resigned as secretary to Marilyn M. Voigt. *Tina Martin*, formerly with National Systems Management, Inc., filled the position vacated by *Margaret Parr-Record* as secretary to Portney, Mullahy, and Voigt.

Renewable Resources. Senior Fellow *Irving Hoch* resigned after eighteen years to become professor and director of the Center for Applied Research at the School of Social Science of the University of Texas, Dallas. *John M. Antle*, a 1984–1985 Gilbert F. White Fellow and associate professor of agricultural economics, University of California, Davis, is developing a methodological framework to evaluate the benefits and costs to farm producers of pesticide regulations. *I. J. Bourke* of the Forest Research Institute in New Zealand and Andre Mayer Fellow at the Food and Agriculture Organization of the United Nations is a visiting scholar at RFF working with the Forest Economics Policy Program. *Thomas Stockton*, who recently received a master's degree in environmental management from Duke University, joined the staff as research assistant to John V. Krutilla. *Vivian Papsdorf*, formerly with Queens College of the City of New York, and *Roxana Salinas*, formerly with the United Nations World Health Organization, joined the staff as secretaries. *Richard Krasnow*, from Harvard University's Biological Laboratories, and *Tim T. Phipps*, from the University of Maryland, joined the National Center for Food and Agricultural Policy as fellows. *Margaret S. Andrews* from Rutgers University, *Glenn L. Nelson* from the University of Minnesota, *Gordon C. Rausser* from the University of California, Berkeley, and *Katherine L. Clancy* from Syracuse University returned to their respective institutions after spending a year as resident fellows with the national center. *Cris Coffin*, who formerly worked at the Wilderness Society, joined the national center as a research assistant. The national center's secretarial support staff now includes *Ann E. Checkley* and *Mary Ann Daly*.

Financial statements

Price Waterhouse

November 27, 1985

To the Board of Directors of
Resources for the Future, Inc.

In our opinion, the accompanying statement of assets, liabilities and fund balances and the related statements of revenue and expenses and changes in fund balances, of sources and uses of cash and of functional expenses, present fairly the financial position of Resources for the Future, Inc. at September 30, 1985, and the results of its operations and changes in its fund balances and sources and uses of cash for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year. Our examination of these statements was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

Our examination was made primarily for the purpose of forming an opinion on the basic financial statements taken as a whole. The additional information, included in Exhibits I and II, is presented for purposes of additional analysis and is not a required part of the basic financial statements. Such information has been subjected to the auditing procedures applied in the examination of the basic financial statements and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as a whole.

Price Waterhouse

Statement of assets, liabilities, and fund balances
September 30, 1985
(Notes 1 and 2)

	Operating Fund	Reserve Fund	Total
ASSETS			
Cash	$ 67,745		$ 67,745
Investments, at market value (Note 3)	206,510	$24,848,014	25,054,524
Investment income receivable	286,267		286,267
Grants and contracts receivable	227,659		227,659
Other receivables	77,746		77,746
Fixed assets, less accumulated depreciation of $843,769 (Notes 4 and 6)	12,275,726		12,275,726
	$13,141,653	$24,848,014	$37,989,667
LIABILITIES AND FUND BALANCES			
Grants payable	$ 174,157		$ 174,157
Accounts payable and accrued liabilities	714,396		714,396
Due to broker		$ 204,943	204,943
Deferred revenue	1,223,328		1,223,328
Building notes (Note 5)	7,159,108		7,159,108
Fund balances	3,870,664	24,643,071	28,513,735
	$13,141,653	$24,848,014	$37,989,667

Statement of revenue and expenses and changes in fund balances for the year ended September 30, 1985 (Notes 1 and 2)

	Operating Fund	Reserve Fund	Total
Revenue			
Grants and contributions unrestricted	$ 551,100		$ 551,100
Grants and contracts restricted	3,183,448		3,183,448
Investment income	52,922	$ 1,574,938	1,627,860
less - investment and custodian fees	(3,331)	(152,217)	(155,548)
Rental income (Note 4)	191,458		191,458
Total revenue	3,975,597	1,422,721	5,398,318
Expenses			
Research programs			
Energy and materials	616,897		616,897
Quality of the environment	808,738		808,738
Renewable resources	1,810,071		1,810,071
Grants	192,372		192,372
Education and communication	501,818		501,818
Administration	1,919,083		1,919,083
Building operations (Notes 4, 5 and 6)	421,279		421,279
Total expenses	6,270,258		6,270,258
Excess of revenue (expenses) before change in market value of investments	(2,294,661)	1,422,721	(871,940)
Increase in market value of investments including realized gains and losses	10,923	2,645,557	2,656,480
Excess of revenue (expenses)	(2,283,738)	4,068,278	1,784,540
Transfers between funds	2,722,721	(2,722,721)	
Fund balances at beginning of year	3,431,681	23,297,514	26,729,195
Fund balances at end of year	$3,870,664	$24,643,071	$28,513,735

Statement of sources and uses of cash for the year ended September 30, 1985

Sources of cash	
Excess of revenues over expenses	$1,784,540
Items not using (providing) cash	
Depreciation	269,718
Increase in market value of investments, net	(2,656,480)
Cash used for operations	(602,222)
Sale of securities, net	1,938,819
Decrease in other receivables	93,017
Decrease in grants and contracts receivable	111,126
Increase in grants payable	85,422
Increase in accounts payable and accrued liabilites	289,359
Increase in deferred revenue	279,601
Increase in building notes	659,108
Total cash provided	2,854,230
Uses of cash	
Decrease in due to broker	191,532
Real estate capital investment, net	2,398,935
Purchase of furniture and equipment, net	224,048
Increase in investment income receivable	36,694
Total cash used	2,851,209
Cash increase during year	3,021
Cash at beginning of year	64,724
Cash at end of year	$ 67,745

Statement of functional expenses
for the year ended September 30, 1985

	Energy and Materials	Quality of Environment	Renewable Resources	Grants	Education and Communication	Administration	Building Operations	Total
Salaries	$278,354	$ 439,502	$ 771,648	$ 9,553	$233,355	$ 950,244		$2,682,698
Benefits	70,980	112,071	196,781	2,438	59,505	275,074		716,849
In-house Consultants	46,205	4,298	471	2,025	473	1,260		54,732
Total Salaries and Benefits	395,539	555,873	968,842	14,014	293,333	1,226,578		3,454,279
Occupancy Costs	51,420	72,195	125,963	1,822	38,133	160,718	$ 86,574	536,825
Word Processing	8,649	13,783	22,745	4,930	14,972	(69,558)		(4,479)
Computer Services	4,191	38,757	51,301		3,967	26,864		125,080
Outside Consultants	59,387	38,934	140,993	1,115	20,644	24,683		285,956
Conferences and Meetings	2,405	500	54,668		6,401	18,999		82,753
Travel	14,782	13,863	41,717	3,950	16,247	22,529		113,088
Publications	2,635	(1,438)	9,473	665	10,617	30,961		52,913
Book Manufacture		1,500	6,000		118,708			126,208
Sale of Books		(789)	(420)		(101,047)			(102,256)
Sub-contracts	10,000	52,199	34,800					96,999
Professional Services			7,500	(5,000)	40,057	30,564		73,121
Communications	3,608	6,808	11,315	4,358	28,231	96,215		149,617
Other	64,199	14,353	23,713	7,817	11,355	225,553		346,990
Fellowship Stipend		3,000	57,581	59,250				119,831
Grants			254,200	99,431				353,631
Depreciation on Furniture and Fixtures						124,977		124,977
Building Operating Expenses							217,251	217,251
Interest on Building Indebtedness							372,713	372,713
Depreciation on Building							144,741	144,741
Imputed Rent							(400,000)	(400,000)
Total	221,358	252,865	841,129	178,358	208,485	692,505	421,279	2,815,979
Total Functional Expenses	$616,897	$ 808,738	$1,810,071	$192,372	$501,818	$ 1,919,083	$ 421,279	$6,270,258
			FUNCTIONAL EXPENSES WITH FULL ABSORPTION OF ADMINISTRATIVE COSTS					
Total Functional Expenses	$616,897	$ 808,738	$1,810,071	$192,372	$501,818	$ 1,919,083	$ 421,279	$6,270,258
Overhead - General Fund	242,616	312,174	522,103	11,679	234,537	(1,323,109)		
Overhead - Reimbursable	98,268	166,838	312,607		18,261	(595,974)		
Total Overhead	340,884	479,012	834,710	11,679	252,798	(1,919,083)		
Total on Full Absorption Basis	$957,781	$1,287,750	$2,644,781	$204,051	$754,616	$ 0	$ 421,279	$6,270,258

Notes to the
financial statements
September 30, 1985

Note 1 - Operations

Resources for the Future, Inc. (RFF) is a nonprofit tax-exempt corporation headquartered in Washington, D.C. It was established in October 1952 with the cooperation of the Ford Foundation. Its purpose is to advance the development, conservation, and use of natural resources and to improve the quality of the environment through programs of research and education.

Note 2 - Significant Accounting Policies

The operating fund includes those amounts available for current activities. The reserve fund includes those amounts which are income-producing for future operations.

Revenue from restricted grants and contracts is recorded only when costs, chargeable to the specific grant or contract, have been incurred. Amounts which have been received but not expensed are reflected as deferred revenue.

Expenses are recorded when incurred. Expenses relating to grants and subcontracts are recorded at the time of approval by the directors or the president.

Direct costs are charged to programs on an actual basis. Administration costs (overhead) are allocated to the programs based upon their proportion of direct salaries and benefits to total direct salaries and benefits. The programs have been summarized on a functional basis in the statement of functional expenses.

Administration costs of $595,974 were reimbursed under grants and contracts performed within the research programs.

Investments are carried at market value. The net change in market value of investments is comprised of realized and unrealized gains or losses determined by comparison of cost to proceeds or market value, respectively.

Furniture and equipment are stated at cost and depreciated over their estimated useful lives on a straight-line basis, ranging from four to ten years. Buildings are depreciated on a straight-line basis over 30 years.

RFF employees are eligible for participation in RFF's retirement annuity program which is administered through the TIAA/CREF insurance companies. Individual contracts issued under the plan provide for full and immediate vesting of both RFF's and the participants' contributions. RFF's contributions amounted to $343,792 for the year ended September 30, 1985.

Note 3 - Investments

A summary of investments held at September 30, 1985 follows:

Operating Fund	Cost	Market
Commercial paper	$ 88,706	$ 88,706
Mutual fund	109,381	117,804
Total Operating Fund	$198,087	$206,510

Reserve Fund	Cost	Market
Fixed income securities -		
Commercial paper	$ 1,248,047	$ 1,248,047
U.S. Government and U.S. Government Agencies	5,440,941	5,823,344
Corporate bonds	1,600,358	1,726,250
Preferred and common stock	10,984,876	11,759,994
Other	3,580,775	4,290,379
Total Reserve Fund	22,854,997	24,848,014
Total Investments	$23,053,084	$25,054,524

Note 4 - Fixed Assets

Fixed Assets at September 30, 1985 consisted of the following:

	Cost	Accumulated Depreciation	Net
Land	$ 3,676,956		$ 3,676,956
Building	8,050,122	$399,741	7,650,381
Furniture and equipment	755,087	444,028	311,059
Construction in progress	637,330		637,330
	$13,119,495	$843,769	$12,275,726

In 1983 RFF purchased land and a building for approximately $9,600,000 through unrestricted cash funds and assumption of a $6,500,000 building mortgage from the previous owner; RFF paid this mortgage in early August 1985 to exercise a $495,000 early payment discount. The early payment discount has been applied to reduce the original cost assigned to the building and the land. The mortgage was replaced with new borrowings. (See Note 5) The previous owner rented office space from RFF under a 17 month lease which terminated on October 31, 1984.

RFF has entered into a cooperative arrangement with an adjoining property owner for the purpose of improving the existing building and converting it to commercial offices. RFF occupies space in the building with remaining space rented to various special purpose tenants. In fiscal year 1985, RFF's portion of the rent was $400,000 which has been charged to occupancy expense. Of this amount $200,000 represents that portion of the rent income applicable to its share of the operations of the building.

Note 5 - Building Notes

The building mortgage consists of a $6,000,000 promissory note, secured by land and building, due August 6, 1986. The note bears interest at floating rates based on 90-day bank certificate of deposit rate, and interest only is payable monthly. Interest payments for the year ended September 30, 1985 were $682,648, of which $372,713 was charged to expense and $309,935 was capitalized.

RFF received $1,200,000 in interest-free advances during fiscal year 1985 from the adjoining property owner in the cooperative arrangement; the funds were primarily used to finance building renovations. As of September 30, 1985, the outstanding balance on these advances was $1,159,108.

Note 6 - Plan for Sale and Development of Property

The Board of Directors of RFF authorized a plan to develop property in Washington, D.C. in cooperation with an adjoining property owner. As of September 30, 1985, $637,330 has been expended for development costs and is included in construction-in-progress. It is expected that final approval of the plan will be made and construction will begin in early 1986. As of September 30, 1985 no construction contracts have been signed.

RFF has entered into an agreement to sell land with a carrying value of approximately $1.9 million. The sale, which should be finalized in January 1986, provides for a selling price of approximately $2.1 million.

Note 7 - Tax Status

RFF is an organization exempt from federal income taxation as described in Internal Revenue Code Section 501(c)(3). In 1984 RFF received notification from the Internal Revenue Service that it is not a private foundation within the meaning of Section 509(a) of the Code; rather, RFF is an organization described in Sections 509(a)(1) and 170(b)(A)(vi) of the Code. The effective date of the determination is October 1, 1978.

Although RFF is subject to tax on unrelated business income from rental charges on occupancy of its debt financed real estate, no tax liability was incurred as of September 30, 1985.

RESOURCES FOR THE FUTURE, INC.

EXHIBIT I

Revenue from grants, contributions, and contracts for the year ended September 30, 1985 (additional information)

	Total	Revenue earned		Balance as of September 30, 1985
		Previous Years	Current Year	
UNRESTRICTED				
The William and Flora Hewlett Foundation	$ 400,000	$ 200,000	$200,000	
Exxon Corp.	600,000	515,000	85,000	
General Electric Foundation	140,000	120,000	20,000	
Others under $100,000	990,400	744,300	246,100	
Total Unrestricted	$2,130,400	$1,579,300	$551,100	
RESTRICTED				
Foundations				
William H. Donner Foundation, Inc.				
A national assessment of water resource issues	$ 150,000	$ 101,415	$ 28,490	$ 20,095
The Ford Foundation				
The Seventh Continent: Antarctica in a Resource Age	24,850		17,865	6,985
General Service Foundation				
Assessment of water resources issues	10,000	8,851	674	475
W. K. Kellogg Foundation				
National Center for Food and Agricultural Policy	4,452,800	327,218	1,039,291	3,086,291
The Esther A. and Joseph Klingenstein Fund, Inc.				
Updating Current Issues in U.S. Environmental Policy	20,000		20,000	
The Henry Luce Foundation, Inc.				
Rice Economy of Asia	50,000	21,125	28,875	
The Andrew W. Mellon Foundation				
Series of environmental studies	750,000	378,471	78,958	292,571
Soil erosion and agricultural productivity	400,000	361,550	22,232	16,218
Reducing the generation of hazardous waste	275,000		4,848	270,152
Natural science fellowships	150,000	84,660	22,477	42,863
Richard King Mellon Foundation				
Land use and spatial economy	250,000	246,185	3,775	40

	Total	Revenue earned: Previous Years	Revenue earned: Current Year	Balance as of September 30, 1985
Foundations (continued)				
Jessie Smith Noyes Foundation				
Dissertation fellowships in food and agriculture	$ 140,500	$ 107,553	$ 32,947	
The J. Howard Pew Freedom Trust				
Policy affecting the coal industry	200,000		32,675	$ 167,325
The Rockefeller Foundation				
Policy options designed to protect agricultural productivity	300,000	172,586	95,613	31,801
Rice Economy of Asia	14,300		14,300	
Alfred P. Sloan Foundation				
Alternatives to direct regulation	573,500	566,411	3,270	3,819
Economics of mineral exploration	160,000	60,948	46,419	52,633
Weyerhaeuser Company Foundation				
Forest Economics and Policy Program	674,583	507,082	87,356	80,145
Various foundations				
A critical history of International Atomic Energy Agency	278,887	44,420	120,398	114,069
Various foundations				
Policy Education Program	166,000	38,744	61,692	65,564
Total Foundations	9,040,420	3,027,219	1,762,155	4,251,046
Other Institutions				
Burlington Northern, Inc.				
National Center for Food and Agricultural Policy	10,000		10,000	
Association of Environmental and Resource Economists				
Cost reimbursement	18,988	16,185	2,803	
Brookings Institution				
Energy and national security	958,562	830,886	84,785	42,891
Decision Focus, Inc.				
Air visibility benefits	63,203		5,637	57,566

	Total	Revenue earned: Previous Years	Revenue earned: Current Year	Balance as of September 30, 1985
Other institutions (continued)				
Harvard University Natural gas project participation	$ 10,000		$ 7,364	$ 2,636
Jackson Hole Preserve Outdoor recreation policy cost reimbursement	43,000	$ 40,136	2,350	514
Johns Hopkins University U.S.-Japan forest products trade	15,244		7,250	7,994
Monsanto Company National Center for Food and Agricultural Policy	15,000		15,000	
Urban Institute Changing domestic priorities	91,809	80,866	943	
Various corporations Natural gas pipeline after wellhead decontrol	125,000		43,937	81,063
Various corporations Mineral Economics and Policy Program	120,151	77,966	21,602	20,583
University of California Farm real estate	5,000	4,848	152	
Total Other Institutions	1,475,957	1,060,885	201,805	213,267
Government				
Bonneville Power Administration Development of BPA fish and wildlife mitigation accounting policy	486,622		10,319	476,303
National Science Foundation				
Conference on the methodology of economics	6,206		4,111	2,095
Design of policies for point sources of pollution	118,506		6,254	112,252
Productivity analysis of the longitudinal establishment data base	298,300		80,863	217,437
Valuation of public forest and range land resources	142,663	111,999	10,339	20,325
Oak Ridge National Laboratory Global effects of worldwide emissions on the atmosphere	50,000		5,148	44,852

EXHIBIT I

	Total	Revenue earned: Previous Years	Revenue earned: Current Year	Balance as of September 30, 1985
Government (continued)				
U.S. Agency for International Development				
Raipur fuelwood study	$ 50,000	$ 51	$ 24,579	$ 25,370
Transport energy	50,000		50,000	
U.S. Department of Agriculture				
U.S. Forest Service				
Forest Economics and Policy Program	1,456,297	1,206,297	230,184	19,816
U.S. Soil Conservation Service				
Soil erosion and productivity	85,000	2,571	69,934	12,495
Data summaries at the aggregated subarea geographic unit level	30,000		30,000	
U.S. Department of State				
Oil proliferation in non-oil developing countries	200,000	130,000	70,000	
U.S. Environmental Protection Agency				
Human health benefits analysis	515,542	484,516	24,440	6,586
Analysis for integrated waste management	152,273	80,177	7,692	64,404
Benefit/cost analysis in water pollution control	224,161	172,523	27,079	24,559
Recreational fishing, swimming, and boating	290,778	277,826	12,952	
Methods for developing water pollution control analysis	731,822	475,642	243,015	13,165
Efficiency of environmental regulations	51,330	20,817	11,912	18,601
Alternative national ambient air quality standards for ozone	332,848	244,165	63,300	25,383
Economic efficiency - groundwater pollution	175,000	169	30,406	144,425
Ozone agricultural model	9,900		7,947	1,953
Simulation model of national pollution loadings and evaluation	210,000		190,654	19,346
U.S. Nuclear Regulatory Commission				
Effectiveness and performance of the advisory committee on reactor safeguards	8,560		8,560	
Total Government	5,675,608	3,206,753	1,219,488	1,249,367
Total Restricted	$16,191,985	$7,294,857	$3,183,448	$5,713,680

Statement of grants and dissertation fellowships for the year ended September 30, 1985 (additional information)

	Balance September 30, 1984	Grants awarded (reductions)	Payments made (refunds)	Balance as of September 30, 1985
Small Grants Program				
American Academy of Arts and Sciences Support for a Moscow meeting on sustainable development of the biosphere		$ 3,000	$ 3,000	
Association of Environmental and Resource Economists Institutional grant		1,500	1,500	
International Institute for Applied Systems Analysis Institutional grant	$ 1,000		1,000	
Massachusetts Institute of Technology Canadian-U.S. international fishing boundary dispute		9,746	9,746	
Michigan Technical University The role of wolf predation in regulating a moose population	8,027		8,027	
Research Foundation of the State University of New York at Stony Brook Estimation of dynamic investment functions	10,278		10,278	
Tufts University Productivity growth and capacity utilization in the electric utility industry during the OPEC decade: an empirical analysis	20,478		10,239	$10,239
University of British Columbia What have we learned since Hotelling? A critical review of the theory of exhaustible resources	4,500		4,500	
University of California, Los Angeles The effects of alternative tax and leasing policies for the outer continental shelf		16,865	8,433	8,432

EXHIBIT II

	Balance September 30, 1984	Grants awarded (reductions)	Payments made (refunds)	Balance as of September 30, 1985
Small Grants Program (continued)				
University of Cincinnati An international conference on the economics of environmental protection in Mexico: strategies and consequences	$ 3,575			$ 3,575
University of Houston Law Center Compulsory unitization of oil and gas fields in Texas: the common law and proposals for reform		$ 3,500	$ 3,500	
University of Nebraska Tennessee's copper basin--a new look at an old problem	14,883		7,400	7,483
University of Texas The acceptability of chemical risks in the environment		15,575		15,575
University of Virginia Production efficiency, rationing and measurement error in industrial factor demand models for developing countries		20,343		20,343
University of Wisconsin Contingent valuation: a test of validity	25,994		25,994	
University of Washington Yosemite National Park and its resources: a centennial history		30,000		30,000
Refunds		(1,098)	(1,098)	
Subtotal	88,735	99,431	92,519	95,647

	Balance September 30, 1984	Grants awarded (reductions)	Payments made (refunds)	Balance as of September 30, 1985
National Center for Food and Agricultural Policy Small Grants				
Harvard University Conversion of American wetlands to agricultural uses		$ 15,000	$ 7,500	$ 7,500
Harvard University, Institute for International Development Managing national food systems: a capacity development approach		20,000	10,000	10,000
Harvard University, Institute for International Development Economic aspects of plant genetic resources		5,000	5,000	
International Food Policy Research Institute The role of pressure groups and of ideology in international agricultural trade negotiations		10,000	5,000	5,000
Michigan State University Economic policy issues of emerging agricultural biotechnologies		10,000	10,000	
Purdue University Soil and water conservation: implications of social and economic research		10,000	10,000	
Soil Conservation Society of America For clean water: creating public awareness of nonpoint pollution issues		7,500	7,500	
University of Arizona Non-tariff barriers in international beef trade		12,000	11,990	10
University of California, Berkeley An examination of the goals and implementation of agricultural policy in the U.S.		$ 15,000	$ 7,500	$ 7,500
University of California, Berkeley Styles of economic development, strategies of food security, and United States grain exports		10,000	5,000	5,000
University of Hawaii An explanation of legislative behavior concerning agricultural policy		14,000	7,000	7,000
University of Maryland Political economy of rice policy in Asia and the U.S.		10,000	5,000	5,000
University of Minnesota Dynamics of agricultural research-agricultural output relationship		30,000	15,000	15,000

EXHIBIT H (continued)

	Balance September 30, 1984	Grants awarded (reductions)	Payments made (refunds)	Balance as of September 30, 1985
National Center for Food and Agricultural Policy Small Grants (continued)				
University of Missouri				
Conservation easements: an integrated policy approach to soil erosion and agricultural supply control		17,000	17,000	
University of Oklahoma				
Retirement of irrigated lands in the Ogallala aquifer region		7,700	7,700	
Urban Institute				
U.S. immigration reform and Mexico-U.S. migration decisions		20,000	10,000	10,000
Virginia Polytechnic Institute and State University				
Managing environmental risk: the case of agricultural nonpoint source pollution of groundwater		$ 13,000	$ 6,500	$ 6,500
Subtotal		226,200	147,690	78,510
National Center for Food and Agricultural Policy Dissertation Fellowships				
University of California, Berkeley				
Food and agricultural resource use policy		14,000	14,00	
University of Minnesota				
Economic efficiency when markets are incomplete: the case of U.S. grain		14,000	14,000	
Subtotal		28,000	28,000	
Total Grants and Dissertation Fellowships	$88,735	$353,631	$268,209	$174,157

SOURCES OF SUPPORT

Resources for the Future is supported by foundation and corporate sources that provide unrestricted funds for general institutional support, and by foundation and government sources whose funds are restricted for particular projects. Investment income from RFF's Reserve Fund, which functions as an endowment, also provides an important segment of general support to the institution. This diversity and breadth of funding is critical to the organization's independence and objectivity.

Unrestricted funds, including grants from business and industry as well as endowment income, amount to approximately 40 percent of total support. The remaining 60 percent of the program's support comes from restricted grants from foundations, government agencies, and, to a limited extent, from business. Resources for the Future does not accept support for specific research projects from individual corporations, nor does it perform proprietary research. However, funding from corporations in partnership with government and foundation grants to support broad program areas is desirable. Programs benefiting from this type of restricted support from the private sector are the Forest Economics and Policy Program, the Mineral Economics and Policy Program, the Natural Gas Program, the National Center for Food and Agricultural Policy, and the Policy Education Program.

The preceding audited financial statements list all restricted funds and major unrestricted grants received from foundations, government, industry, or other institutions during fiscal 1985. Foundation and corporate supporters from October 1, 1984, through September 30, 1985, include the following:

COMPANY-SPONSORED FOUNDATIONS AND CORPORATE CONTRIBUTORS

Alcoa Foundation
AMAX Foundation, Inc.
American Natural Resources Company
American Telephone and Telegraph Company
Atlantic Richfield Foundation
BP North America Inc.

Bankers Trust Company
Burlington Northern Foundation
Cargill, Inc.
Carolina Power & Light Company
CBS Inc.
Champion International Corporation
Chemical Bank
Chevron U.S.A. Inc.
Consolidated Edison Company of New York, Inc.
Crown Zellerbach Foundation
E. I. Du Pont de Nemours & Company/Conoco Inc.
Exxon Corporation
The General Electric Foundation
Gulf Oil Foundation
Houston Natural Gas Corporation
International Business Machines Corporation
Interstate Natural Gas Association of America
The Mead Corporation
Metropolitan Life Foundation
Mobil Oil Corporation
Monsanto Company
The New York Times Company Foundation, Inc.
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Pacific Lighting Gas Supply Company
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Public Service Electric and Gas Company
Scallop Corporation
Scott Paper Company Foundation
SOHIO—The Standard Oil Company
Sun Company, Inc.
Tenneco Inc.
Texaco Philanthropic Foundation, Inc.

Transco Energy Company
Union Carbide Corporation
Union Oil Company of California
Union Pacific Foundation
Weyerhaeuser Company Foundation

INDEPENDENT FOUNDATION CONTRIBUTORS

Carnegie Corporation of New York
The William H. Donner Foundation, Inc.
The Ford Foundation
General Service Foundation
The George Gund Foundation
The William and Flora Hewlett Foundation
W. Alton Jones Foundation, Inc.
W. K. Kellogg Foundation
The Esther A. and Joseph Klingenstein Fund, Inc.
The Henry Luce Foundation, Inc.
The Andrew W. Mellon Foundation
Jessie Smith Noyes Foundation, Inc.
J. Howard Pew Freedom Trust
Anne S. Richardson Fund
Rockefeller Brothers Fund
The Rockefeller Foundation
Alfred P. Sloan Foundation

Robert W. Fri will be the next president of Resources for the Future. Elected at a special meeting of its board of directors on December 19, 1985, he will be the sixth president in RFF's thirty-three year history.

Currently president of the Energy Transition Corporation, Fri was the first deputy administrator of the Energy Research and Development Administration from 1975 to 1977 and was acting administrator of the agency when it became part of the new Department of Energy in 1977. He received ERDA's Gold Medal for Distinguished Service in 1976.

From 1971 to 1973 Fri was the first deputy administrator of the Environmental Protection Agency and concluded his service there as acting administrator. For some ten years he was a member of McKinsey and Company, Inc., management consultants, and was elected a principal of the firm in 1968.

An honors graduate in physics of Rice University, Fri received an M.B.A. with distinction from the Harvard Business School, where he was a Baker Scholar. He held a commission in the U.S. Navy from 1959 to 1962.

Among other responsibilities, Fri was attached to the White House to undertake a major review of commercial nuclear fuel processing for President Gerald R. Ford. And, in 1977, he led the U.S. delegation to the General Conference of the International Atomic Energy Agency.

The new president will assume his post on March 1, 1986.

Resources for the Future, Inc. 1616 P Street, N.W. Washington, D.C. (202) 328-5000